# PROGRESSIVE

# MEDICINE

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# PROGRESSIVE MEDICINE

## A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES AND IMPROVEMENTS

### IN THE

## MEDICAL AND SURGICAL SCIENCES

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SURGERY OF THE HEAD AND NECK—SURGERY OF THE THORAX, EXCLUDING DISEASES
OF THE BREAST—INFECTIOUS DISEASES, INCLUDING ACUTE RHEUMATISM,
CROUPOUS PNEUMONIA, AND INFLUENZA—DISEASES OF CHILDREN
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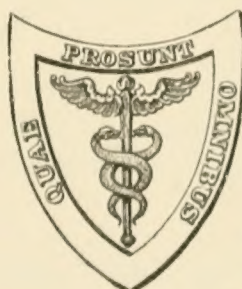
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# PROGRESSIVE MEDICINE.

## MARCH, 1916.

## SURGERY OF THE HEAD AND NECK.

### By CHARLES H. FRAZIER, M.D.

**THE CRANIAL NERVES.**

**Trigeminal Neuralgia.** Of all the fields in neurological surgery, the most attractive and appealing is that of trigeminal neuralgia. The results are indeed gratifying and satisfying to both patient and surgeon. At the present time our attention has been directed chiefly to the effect and technic of *alcoholic injections*, both peripheral and central. Why is the relief following injection so transitory when physiological experimentation has proved that this procedure is sound in theory? In which cases should we resort to injection rather than the radical operation? And in which cases to a central rather than a peripheral injection? The almost astounding results which have followed the radical operation, and its very low mortality-rate in the hands of those experienced in cranial surgery, have placed this procedure beyond the realm of dispute. Whether the time will come when alcoholic injections of the ganglion will prove equally effective remains for the future to decide. Certainly they are in no sense now a substitute for the radical operation. Theoretically, we should expect this to be the case, but practically the results thus far have not been sufficiently permanent and they have not been without complications. But sufficient time has not yet elapsed for us to pass final judgment upon this procedure. Experience has proved the inefficiency of the peripheral operation, and we have abandoned the so-called Theirsch avulsion in favor of alcoholic injections; the latter are quite as effective, more enduring, and involve "no cutting." While the past two years brings forth little new from the standpoint of method and technic, many contributions have been made in the form of clinical reports and analyses. I am still of the opinion, as I was when I reviewed the subject two years ago, that in cases of major neuralgia

the radical operation is the treatment *par excellence* when the patient is in good general health and in the prime of life, unless there are circumstances forbidding a major operation.  Patrick, with his enormous experience, has expressed very much the same view.  How often patients who have had three or four alcoholic injections, or more, say after the major operation, "Why did we not have the major operation in the first instance, and be spared the dreadful alcohol injections with the inevitable recurrences?"  However, I find myself using alcoholic injections very frequently.  The psychology of the patient must be taken into account.  Having had but one attack of major neuralgia, the patient is not willing to consider a formidable operation.  Naturally enough, having survived the first attack and the pain having disappeared altogether, he encourages himself to believe there will be no recurrence.  A second attack saps his courage somewhat, and he welcomes the relief of an alcoholic injection.  This he hopes will cure him, but he is disheartened when the third attack strikes him like a bolt of lightning, and he begins to become demoralized.  He is willing to try the injection again, and if this does  not  give him entire relief or he has another recurrence, he has become desperate and pleads for some treatment that assures him lasting relief.  This is a very common sequence of events, and invariably the suggestion of a radical operation is made by my patients, and not by me.

Krause[1] believes that, in general, extirpation of the ganglion should be undertaken only after alcoholic injections and the less grave operations have failed, but he also believes that the time will come when further refinements in technic will have so lessened the dangers of the radical operation that it will be given preference over all other operations.  While the radical operation must still be regarded as a grave one, nevertheless the results have been so satisfactory, the mortality has been so reduced in experienced hands, that I advocate the operation in all appropriate cases.

There is still some difference of opinion as to the method of approach and the tissue to be removed.  There now seems to be a tendency, however, to favor resection of the sensory root, although the results following gasserectomy, as performed by Horsley, Krause, Cushing, Lexer, and others, have been for the most part satisfactory.  Maes,[2] in his recent review on the "Surgical Treatment of Tic Douloureux," makes the following statement in regard to the various radical procedures for the cure of trigeminal neuralgia: "The consensus of opinion among most surgeons is that Frazier's method of approach, combined with Spiller's suggestion of division of the sensory root, is probably the most practical of the present-day operations.  The Hartley-Krause method

[1] Chapter on Die Neuralgien des Kopfes in Handbuch der Praktischen Chir., 1913, Bd. i, p. 680.
[2] Surg., Gyn. and Obst., Int. Abst. of Surg., 1915, xxi, 349.

of exposure is unnecessarily large and may include some fibers of the facial, causing paralysis of the orbicularis palpebrarum, thereby contributing to the keratitis. The methods of Cushing and Lexer are similar to the Hartley-Krause operation, but the flap is much lower down. Cushing removes the zygoma, while Lexer replaces it at the completion of the operation. Kocher includes practically the same tissues but reverses the attachment of the flap. In this way the larger part of the horseshoe is down to the zygoma and gives more room for viewing the basal foramina from within the skull. Doyen divides the temporal attachment to the coronoid process of the maxilla beneath the zygoma and reattaches it at the end of the operation. Kocher avulses the sensory root and claims to have had no recurrences. . . . The advantages of Frazier's operation are: (1) Approach is more posterior, and is therefore less likely to involve the upper fibers of the facial. (2) A comparatively small opening diminishes the liability to hernia. (3) Special technic of dealing with the middle meningeal artery should be noted. (4) Division or avulsion of the sensory root only, with less frequent occurrence of the distressing neuroparalytic keratitis. (5) Cerebral complications have been far less frequent than formerly. (6) If the sensory root is not easily recognizable, we can always have recourse to one of the other suggestions, such as complete removal of the ganglion (Hartley-Krause, Lexer, Cushing, and Horsley), or section of the second and third divisions (Hutchinson, Kanavel, Abbe, Harris, Mixter, and others)." Two of the principal advantages of the method devised by Spiller and myself have not been mentioned by Maes, namely: That it is attended with less hemorrhage because the ganglion is not raised from its bed; and also that it does not expose to injury the adjacent structures, particularly the cavernous sinus and the three cranial nerves.

Rawling, in his book on *Surgery of the Skull and Brain*, states: "From my own experience I have come to the conclusion that the two operations of choice are resection of the second and third divisions of the fifth nerve and division of the sensory root. The former of these two operations is carried out when the general condition of the patient is not altogether satisfactory, presuming, of course, that the neuralgia is limited to those divisions of the nerve. Under more favorable circumstances, excellent results are obtained by exposure and division or resection of the sensory root, with, I think, the minimum risk. As regards Abbe's operation, recurrence may take place if the basal foramina are not completely occluded, some few nerve fibers growing through the foramina on either side of the occluding medium. Such complications have not taken place in the cases in which I have carried out this operation.

Mixter[1] makes use of the principle of Abbe's operation, but employs

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[1] Journal American Medical Association, 1914, lxiii, 1248.

a mass of amalgam in place of the rubber disk. In a recent case, however, following Kanavel's suggestion, to be referred to in the next paragraph, Mixter has plugged the foramen ovale and rotundum with bone grafts from the tibia; it is too soon as yet to judge of the end-results.

As I have said before, I am not in favor of peripheral operations. Nevertheless, there are exceptional circumstances in which such a procedure may be indicated, as, for example, when alcoholic injections have failed to give relief to patients who are too old or too debilitated to stand the more radical operation, or in patients who will not submit to an intracranial procedure. It may be that Kanavel's[1] recent device of plugging the foramina with bone grafts may prove effective in such cases. As the result of some physiological experiments, he has elaborated the following technic for operations upon the infra-orbital and infra-dental branches, which he has applied once on the living subject: An incision was made in the line of the skin crease just over the infra-orbital and the nerve slowly twisted from its trunk; a pedicle flap of periosteum was reflected and the canal carefully curetted. Then a bone plug three-quarters of an inch long and just the size of the canal was removed from the tibia, a piece of periosteum being left at its outer end. The small bone graft was wedged into the canal down to the attached periosteum, the periosteal flap replaced, and the skin closed. In the infradental branch, the incision was made under the angle of the jaw. After making a crucial incision in the periosteum at the angle over the area of the nerve, a button of the outer plate of bone down to the medulla was removed, the nerve located and twisted from its canal. The canal was then curetted and broken down, the button of the outer plate reinserted after being rotated 90 degrees so that the destroyed canal of the button was at right angles to the canal in the bone. The button was then driven into the medulla between the two tables at the proximal side for a fraction of a centimeter, and the flaps replaced. The slight subsequent facial paralysis disappeared within a week of the operation, and eight months later the patient had no pain with the exception of a slight painful sensation in the tip of the tongue on the left side. There was no paralysis and the scar was not visible to ordinary inspection.

*Peripheral Alcoholic Injections.* Over ten years have elapsed since Schlösser's epoch-making suggestion of injecting the branches of the trigeminal nerve with alcohol at their points of exit from the skull, and we should now be able to recognize its field of usefulness as well as its limitations. That it has been of untold value in relieving pain in cases of trigeminal neuralgia which, for one reason or another, were unsuitable for the radical operation cannot be denied. On the other hand, all who have had a large experience with these peripheral injections report that the relief is but temporary, the average period of freedom

[1] Journal American Medical Association, 1914, lxiii, 1245.

being about a year, and that the results are variable. How is this to be accounted for in view of the fact that the laboratory investigations of Finkelnburg, Brissaud, Déjerine, Levy and Baudouin, and more recently Bersou and Gordon, show that actual degeneration of the nerve from the point of injection to the periphery follows intraneural injections of alcohol.

Gordon[1] made the following observations in a dog sacrificed on the ninth day after injection of alcohol into the infra-orbital nerve: "In the infra-orbital nerve peri- and endoneuritis with accumulation of small cells are seen around and in the vicinity of the smallest nerve bundles. The latter are intact, with the exception of an occasional nervus nervorum which is found degenerated. The Gasserian ganglion shows chromatolysis in some of the cells; the majority of the cells are intact." In a second series, in which the dog was sacrificed on the twenty-ninth day. "The infra-orbital nerve presented perineuritis with a very marked proliferation of round cells around each individual nerve bundle; they are also seen in the adventitia of the arteries. The Gasserian ganglion presents marked chromatolysis and proliferation of cells of the capsule." Some interesting experiments regarding the effects of intraneural injections of alcohol have also been carried on by Bersou[2] upon pigeons at the suggestion of van Gehuchten. Bersou found that alcohol caused a total necrosis of a segment of the nerve proportional to the quantity of alcohol injected, a weak concentration causing only the fragmentation of the nerve fibers. As far as function is concerned, the alcohol results in an anatomical interruption of the nerve, accompanied by Walleriane degeneration in the peripheral segment and regeneration on the part of the central axones. But the necrosed portion acts as a foreign body and prevents a solution of continuity. Alcoholic injections should therefore be even more effective than a resection. Bersou attributes the mutability and variability of the results either to an imperfect understanding of the seat of the lesion or to a failure to penetrate the nerve. Should the lesion be central to the point of injection, one could scarcely expect to relieve the pain, or should the alcohol be placed only alongside the nerve, the relief would be but temporary. For a successful injection, therefore, the injection must be made at a point central to the lesion, the nerve trunk must be penetrated obliquely by the needle, and sufficient alcohol must be injected to cause necrosis over a considerable extent of the nerve.

Patrick[3] who unquestionably has had the largest experience with alcoholic injections, reports that he is now using a very slender irido-platinum needle, as advised by Brissaud and Sicard, in place of the heavier one which Levy and Baudouin advocated. With the new needle he has found that the puncture is less painful and penetration easier.

[1] Journal Nervous and Mental Diseases, 1914, xli, 81.
[2] Le Nevraxe, xiv-xv, 583.                    [3] Loc. cit.

Harris's[1] experience with alcoholic injections now covers 200 cases, and in a paper read before the Section on Nervous and Mental Diseases at the Sixty-fifth Annual Meeting of the American Medical Association, he gives in detail his technic for injecting the different divisions, but as this has been described in previous numbers of PROGRESSIVE MEDICINE I will not dwell on it at this time. While some cases of neuralgia of the second division can be helped by injections of the infra-orbital nerve at its exit on the cheek, in the majority of cases, as Harris observes, the pain is referred to the upper jaw and sometimes to the palate as well, and, in these cases, it is necessary to inject the nerve at the foramen rotundum. Harris has discarded injection of the mental foramen for neuralgia of the third division and always attacks the nerve at the foramen ovale.

In a recent report, Donath[2] speaks most enthusiastically of his experience with peripheral injections. His technic is very similar to that of Levy and Baudouin. Of 16 cases, 11 are reported as cured, 4 improved, and only once was it necessary to discontinue the treatment in the case of a woman, aged sixty-six years, with arteriosclerosis, myodegeneration of the heart and arrhythmia. Recurrences, Donath believes, are no more frequent than after resection; indeed one of his patients has remained free from pain for four years. He feels, therefore, that the injection method of treating neuralgia should be more generally adopted and surgical procedures reserved only for a last resort.

Flesch's[3] recent report of his experience with alcoholic injections in 86 cases of neuralgia is interesting, especially from the standpoint of end-results. Of these 86 cases, 6 patients between the ages of seventy and eighty died of some intercurrent disease, and 18 could not be followed; of the remaining 62, 8 were free from recurrence, while in 54 cases the pain returned at a longer or shorter interval after the injection, as will be seen in the following table:

3 patients had recurrence in 23 to 26 months
16        "                "        16 to 18    "
18        "                "         8 to 12    "
10        "                "         6 to  8    "
 4        "                "         2 to  4    "
 2        "                "         4 to  6 weeks

In the 86 cases, he administered 262 injections, as follows:

10 patients received   1 injection
25        "            "        2      "
24        "            "        3      "
20        "            "        4      "
 5        "            "        6      "
 2        "            "       10      "

[1] Journal American Medical Association, 1914, lxiii, 1725.
[2] Ztschr. f. d. gesamte Neurol. u. Psych., 1915, xxix, 1.
[3] Wien. med. Wchnschr., 1914, lxiv, 281 and 325.

Flesch emphasized the importance of an accurate topographical diagnosis as to the seat of the lesion before the injection is given. He advises, first, the use of the peripheral injection; then, in case this proves of no avail, he resorts to injection at an intermediary point (Braun's method for the inferior dental and lingual; Sicard or Schlösser's method for the posterior and superior dental). If there is still no relief, he proceeds to the deep injections at the foramen ovale or rotundum, and as a last resort there remains injections of the Gasserian ganglion and the radical operation. For injection of the foramen ovale, he has devised a new needle which is 10 cm. long, 1.5 mm. thick, and can be easily bent forward in its distal third.

Bonola[1] has recently devised a slightly different technic for injecting the inferior maxillary nerve at the foramen ovale, for which he claims good results. He selects a point on the ascending maxilla about 1.5 cm. from its posterior margin, drawing a line parallel to this margin, he inserts the needle at an angle of 25 degrees, at the point where the line crosses the sigmoid notch. When the needle has been introduced about 3 cm., it is then slightly turned to the side, maintaining, however, the same direction with respect to the axis of the cranium, and slowly moved forward along the vault of the sigmoid fossa until it finally encounters the trunk of the inferior maxillary nerve and penetrates the foramen ovale.

INJECTION OF THE GASSERIAN GANGLION. We have previously referred[2] to the early attempts to inject alcohol directly into the Gasserian ganglion. Indeed after the destructive influence of alcohol upon nervous tissue had been proved and the feasibility of reaching the foramen ovale demonstrated, it was but natural that the injection therapy should be extended to the Gasserian ganglion in the hope that by destroying the nerve cells in the ganglion, regeneration would be prevented, and the results be just as permanent as those following a gasserectomy or resection of the sensory root. During the past ten years many studies have been made in this direction from an antomical, physiological and clinical point of view, and, while the longest period of observation in any of the reported cases is four years, nevertheless, the results of this form of treatment in the hands of Härtel, Taptas, Harris, Byrnes, and others, have been sufficiently encouraging to warrant a most careful consideration of the subject.

As a forerunner of the subcutaneous injection of the Gasserian ganglion, several attempts were made to inject the ganglion directly after its exposure by the Hartley-Krause method or through the foramen ovale after exposure of the latter structure. Thus, in 1907, Wright injected a few drops of osmic acid into the ganglia of two patients through the foramen ovale, and, in 1910, Sicard injected alcohol in the

[1] Il Policlinico, 1914, xxi, Sez. Chir., p. 153.
[2] PROGRESSIVE MEDICINE, March, 1913, and March, 1914.

same manner; Sicard's patient remained free from pain for eight months. In 1909 Rasumosky simultaneously injected the ganglion and resected the sensory root, and, in 1912, Alexander and Unger obtained very good results from an intracranical injection of the ganglion after the subcutaneous method had failed, and they still maintain (Härtel) that the operative exposure of the ganglion and subsequent injection should be given preference. The first suggestion of injecting the ganglion subcutaneously seems to have been made in 1906 by Ostwald, who advocated the needle being introduced through the mouth behind the third upper molar tooth. In the next year Chollin succeeded in injecting the ganglion on a cadaver by an intrabuccal route similar to Ostwald's, and shortly afterward Harris demonstrated also on a cadaver that the ganglion might be reached by the extrabuccal procedure devised by Levy and Baudouin for injection of the inferior maxillary nerve. About this same time, Byrnes,[1] in his early experiments (1909) on the subject of deep intraneural injections, discovered that the ganglion was accessible through the foramen ovale by the three methods then known for reaching that foramen, namely, the technic of Schlösser, of Ostwald, and of Levy-Baudouin. The first attempt to inject the ganglion subcutaneously on a living subject was made by Pussep, in 1910, according to Ostwald's technic, but the clinical results were far from satisfactory.

Taptas,[2] of Constantinople, reported the first successful injection which he performed in 1909 and which he has since repeated in 8 cases. He introduces the needle at a point midway between the zygomatic arch and the sigmoid notch of the inferior maxilla, and 1 cm. below the perpendicular arch, the needle being directed in a median plane and inclined a little from below upward. The foramen ovale is penetrated immediately behind the base of the pterygoid process. The patient is then asked to open the mouth the external portion of the needle being inclined downward. The needle is no longer stopped by the walls of a bony cavity and penetrates the Gasserian ganglion.

Just a few months after Taptas's first clinical application of alcoholic injection of the ganglion, Harris[3] performed his first ganglionic injection, which he has since repeated in over 60 cases. His technic is similar to that of Levy and Baudouin for injection of the third division, although in his early cases he introduced the needle at a point either on, or slightly below, the line joining the incisura notch to the ala nasi instead of below the lower border of the zygoma, and directed it slightly more upward. He now inserts the needle below the zygoma, however, and finds that by injecting 1.5 c.c. alcohol, *a few drops at a time*, into the nerve at the lips of the foramen the whole territory of the trigeminal nerve gradually becomes anesthetic, the anesthesia appearing first in the third division

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[1] Bull. Johns Hopkins Hospital, 1915, xxvi, 1.
[2] Archives Internat. de Laryn. d'Otol. et de Rhin., 1913, xxxvi, 423.
[3] Journal American Medical Association, 1914, lxiii, 1728.

and then in the second and first. While in many subjects it is possible to push the needle through the lips of the foramen ovale into the ganglion itself, Harris believes that this is rarely necessary. One should be extremely careful to discontinue injection at once if pain is felt deep in the ear, as deafness might ensue; this pain, however, must be distinguished from pain which may occasionally be referred to the outer ear as a result of irritation of the auriculotemporal branch of the third division at the foramen ovale. Care should also be taken to avoid penetrating the pharynx by directing the needle too low. This will rarely happen, however, if one takes the under surface of the sphenoid as a guide.

In 1912 Härtel reported a new technic for injecting the Gasserian ganglion which was based on most elaborate anatomical studies. This procedure, according to Härtel's last communication,[1] is briefly as follows: "The needle is introduced into the cheek at the level of the alveolar margin of the second upper molar tooth, then directed between the ascending ramus of the lower jaw and the maxillary tuberosity around the buccinator muscle to the infratemporal fossa, thus avoiding the mucous membrane. By hugging the hard surface of the planum infratemporale, the foramen ovale is reached, the marked placed at 1.5 cm., and the needle advanced in the same direction as before until pain is experienced in the distribution of the second division."[2] Härtel maintains that this method is superior to that of Ostwald because it avoids the danger of infection, and the direction of the needle makes it possible to penetrate the entire ganglion; he prefers it to the transverse route employed by Harris because the possibility of injury to neighboring structures is avoided, and the needle may be moved with greater freedom.

These, then, are the methods by which injection of the ganglion may be accomplished. What are the *results of their application*, and when should one resort to one of these procedures? Taptas[3] has now injected the ganglion in 8 cases, and there has been no recurrence in any of the cases, the period between the injection and the report being three years and four months in 1 case, and two years and a half in a patient in her eightieth year. Harris[4] who has now injected the ganglion in 60 cases, states that "the cure of the neuralgia is certain, and likely to be permanent, though my first case of injection of the ganglion dates back only four years." Vacher and Denis (quoted by Härtel) have injected the ganglion in 2 cases according to Harris's technic with good results, and Camp[5] has applied it with success in 3 cases, the period of observation being ten months and six months in 2 of the cases, and not stated in a third.

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[1] Deutsch. Ztschr. f. Chir., 1914, cxxvi, 429.
[2] For a more detailed description, see Progressive Medicine, March, 1914.
[3] Loc. cit.          [4] Loc. cit.          [5] Medical Record, 1914, lxxxv, 116.

Härtel's recent monograph on the treatment of trigeminal neuralgia is most illuminating from the standpoint of the effect of ganglionic injections. In 24 of the 25 cases treated in this way, which he has been able to trace, there has been complete freedom from recurrence in 17, the period of observation being over a year in 6 cases, in 1 case, ten months, and in the rest the interval was shorter. Two patients had apparent recurrences, and 5, true recurrences; 3 of the latter received a second injection which was successful. Loevy[1] reported a case injected by the Härtel technic in which there was no recurrence four months after the injection; and Maes[2] reported 1 with no recurrence for one month. Grinker[3] has also reported a successful case, and, according to a personal comunication with Härtel, Streissler (Graz) has employed Härtel's technic successfully. Flesch[4] has given one injection according to this method, but the patient regretted that he had submitted to the injection on account of the intense anesthesia in the entire side of the face and the difficulty which he had in talking and eating, which lasted for some weeks. Flesch has come to the conclusion, therefore, that he will reserve the ganglionic injection for only the very refractory cases which will not yield to the simpler procedures. Hirschel[5] has recently reported his experience with Härtel's technic in 7 cases of trigeminal neuralgia, the intervals between the injection and the report varying from one and a half years to several months. All were obstinate cases of several years' duration, most of them involving all three branches, and all 7 patients have remained free from recurrence after the first injection, although in 2 cases the attacks did not entirely cease until several days after the injection.

Byrnes[6] has used the intraganglionic injections in 14 cases with the following results: "Six patients were treated more than a year ago and are still free of pain—the longest period being eighteen months. Four patients, treated within the last twelve months of this period, have had no return. The 3 patients in whom only partial injections were obtained, returned for further treatment. One patient with carcinoma of the jaw which had invaded the cranial nerves of the middle fossa, producing intense pain in the trigeminal area, died from this primary disease two months after injection, and I could not see that there was any appreciable diminution in the pain."

Regarding the immediate effects of the ganglionic injections, it is usually found that there is no pain accompanying the introduction of the needle until the foramen ovale has been reached. At this point Härtel advises a trial injection of $\frac{1}{4}$–$\frac{1}{2}$ c.c. of a 2 per cent. solution of novocain, which will be followed in a few moments by loss of the corneal reflex

[1] PROGRESSIVE MEDICINE, March, 1914.
[2] Journal Arkansas Medical Society, 1913, x, 174.
[3] Journal of the American Medical Association, 1913.
[4] Loc. cit.
[5] München. med. Wchnschr., 1915, lxii, 5.
[6] Loc. cit.

and analgesia in the entire trigeminal region if the alcohol has penetrated the ganglion. Byrnes and Harris have not found this necessary. They proceed at once to inject a few drops of alcohol, which lessens the pain caused by entering the foramen, and continue the injection a few drops at a time. The spread of the alcohol causes pain in the supra-orbital and maxillary region, but Byrnes has found that the pain associated with ganglionic injections is not much greater than that accompanying the deep intraneural injections, although wider in distribution.

*Complications of Alcoholic Injections.* Experience seems to indicate that injection of the ganglion predisposes to the same complications and necessitates the same precautions as does the radical operation. That a subsequent keratitis may develop cannot be denied, but it is also true that it may usually be prevented here as after the radical operation by careful after-treatment. This should consist, according to Härtel, in keeping the patient in the hospital, from one to several weeks after the injections, in wearing a close-fitting goggle, in the daily use of boracic lotions and a weekly installation of atropin. In Härtel's series of 24 cases, there was permanent anesthesia of the cornea in 14, and *keratitis developed* in 6, but in 5 of the 6 instances of keratitis, the patient was treated as an ambulant patient. Only once did keratitis develop when the above prophylactic measures were observed, and in this instance the patient insisted upon leaving the hospital too soon. Harris states that it should be possible to inject 0.5 c.c. alcohol after total anesthesia appears without risk of the anesthesia being permanent, *providing the entire amount injected does not exceed* 1.5 c.c. If more than 1.5 c.c. is injected, the risk of the development of a keratitis is great, and Harris's practise is to close the eyelids if total anesthesia of the eyeball persists more than half an hour after the injection, and, if it still persists the following day, the lids should be sewed, leaving just a chink at the canthus. He has been obliged to resort to this procedure in 7 cases. There was a temporary conjunctivitis in 3 of Taptas's cases, while Hirschel reports that the corneal reflex did not disappear permanently in any of his cases, and he believes that serious occular complications may be absolutely avoided by keeping the patient in bed for several days with the eye covered. Byrnes reports that it has been his good fortune not to encounter any serious unpleasant results from either the deep neural or ganglionic injections. Both Harris and Härtel mention the almost invariable loss of taste sensation on the affected side, while the sense of smell is usually not affected. Besides the keratitis, Härtel has encountered trophic disturbances in the shape of herpetic eruptions in 6 of his cases, the herpes appearing a few days after the injection and disappearing very shortly. The motor disturbances are seldom serious in character, consisting sometimes of a slight weakness of the masseter and temporal muscles, occasionally (twice in Härtel's series) a weakness or transitory paralysis of the abducens caused by the diffusion of the alcohol through

the outer wall of the cavernous sinus. Härtel also mentions a transitory widening of the pupils and narrowing of the palpebral fissures, but these were only of a few hours' duration.

The development of a keratitis as a complication constitutes to my mind a very serious objection to the alcoholic injections. At least it should be made one of the standards by which the major operation and injection should be compared. Several years ago, I noticed in 2 cases in which I had injected the ganglion with alcohol during the course of an operation, to shorten the period of ether anesthesia, that the cornea was dry, lusterless and hazy for two or three days after the operation. After this experience, I abandoned this innovation immediately. Now I see that out of 25 cases, Härtel had a keratitis in 7, that is in more than a quarter of the total, and if this is borne out by the experience of others, I believe we should call a halt on the ganglion injections until means have been devised of lessening the incidence of keratitis.

Concerning the *end-results of ganglionic injections*, the duration and character of the subsequent anesthesia, I think, for the time being at least, we must admit that they are extremely variable. Immediately after an injection of the ganglion there is almost always complete anesthesia in the entire trigeminal distribution; while this often indicates a complete destruction of the ganglionic cells, it also may mean merely a transitory paralysis. If the latter is the case, there will be a gradual shrinking of the anesthetic area. But if, on the other hand, the anesthesia persists without change for several days, then, according to Härtel's experience, it is permanent. The following table given by Härtel is interesting from the standpoint of the objective results in his 24 cases:

| | |
|---|---|
| Anesthesia and analgesia in all three branches . . . . . . . . . . | 6 times |
| Analgesia in all three branches, sensation for touch not completely lost in all branches . . . . . . . . . . . . . . . . . . . . | 6 " |
| Anesthesia and analgesia in two branches, in the third branch diminished or normal sensation . . . . . . . . . . . . . . . . . . | 2 " |
| Analgesia in two branches, sensation diminished in the other . . . . | 1 " |
| Analgesia in one branch or small area . . . . . . . . . . . . . | 3 " |
| Sensation diminished in all three branches . . . . . . . . . | 1 " |
| Partial diminution of sensation . . . . . . . . . . . . . . . | 4 " |
| Normal sensation . . . . . . . . . . . . . . . . . . . . | 1 " |

According to Byrnes, the return of sensation is sometimes confined to one branch, and usually the ophthalmic. Harris has found, however, that the anesthesia is most intense and lasting in the first division, a fact which is to be deplored because of the effect it would have upon the development of keratitis.

If the anesthesia following the first injection is only transitory, it is always possible to repeat the injection. Indeed the results of laboratory

investigations seem to indicate that this would usually be necessary. May's experiments on cats showed that it was impossible to produce complete destruction of the ganglion from a single injection of alcohol, and Byrnes has come to practically the same conclusion as the result of his recent experiments. Byrnes feels that by repeated injections of the ganglion its complete destruction should be finally accomplished.

Whether it is going to be possible to inject only those portions of the ganglion corresponding to the second and third divisions remains for the future to decide. At present Härtel believes this cannot always be done, and therefore, on account of the possibility of a subsequent keratitis, he has come to the following conclusions: Light and medium cases should be injected only by the peripheral method; severe cases, which have failed to respond to peripheral injections, should be treated by an intracranial injection which should be repeated until there is complete permanent anesthesia of the entire trigeminal region; in cases in which repeated intracranial injections have failed to bring relief or in which puncture of the foramen ovale is impossible because of anatomical peculiarities, resection of the ganglion according to the Krause-Lexer technic is indicated.

Until clinical experience gives us more positive evidence as to the permanency of the results following injections of the ganglion, I feel that its field should be much more limited than Härtel's conclusion would seem to indicate. In view of the fact that the effects of ganglionic injections thus far are variable, and because of the possibility of subsequent complications, I believe that it should be used as a substitute for the radical operation only in those cases in which such an operation is contra-indicated either because of the advanced age of the patient or other deterring factors. In all other cases which have failed to respond to peripheral injections, I believe, for the time being at least, we should resort to the radical operation. In those cases in which a radical operation is out of the question, one should be sure to give the peripheral injections a thorough trial, particularly when the neuralgia is confined to the first and second division, deep injections being given for the second division, and a superficial injection at the supra-orbital foramen for the first. Moreover, Byrnes advocated the use of the peripheral injections in cases in which "the attacks are so severe that immediate relief is urgent, and the patient is unwilling to accept the prospect of failure at any single attempt to reach the ganglion, greater assurance of success, at any one sitting, being offered by the deep neural injection."

In addition to the pure trigeminal neuralgias, alcoholic injections of the Gasserian ganglion may be used for the relief of *symptomatic neuralgia*, such as the pain accompanying inoperable tumors, when direct causal treatment is impossible. Härtel[1] reports that complete anesthesia followed a ganglionic injection in the case of a recurrent sarcoma of the orbit.

[1] Loc. cit.

OTHER APPLICATIONS OF PUNCTURE OF THE FORAMEN OVALE. Härtel[1] has already made use of puncture of the foramen ovale for *diagnostic purposes* in a case of *basilar meningitis*. He also suggests that this would be a most excellent way of bringing tetanus antitoxin into immediate contact with the nerve cells, and reports a case of tetanus which he cured by injecting the antitoxin in this manner.

**Resection of the Auriculotemporal Nerve and Its Effect upon the Secretion of the Parotid Gland.** Based on Claude Bernard's observation that the auriculotemporal nerve is the secretory nerve for the parotid gland, Leriche[2] has recently resected this nerve in 2 cases in order to suppress secretion of the parotid gland, and, according to Leriche and Aigrot,[3] the operation is indicated in the following conditions:

1. Rebellious salivary fistula of the parotid or of Steno's duct.

2. Hypersalivation of certain affections of the esophagus, particularly cancer.

3. Rebellious sialophagic aerophagia.

The nerve is exposed by a vertical incision 3 cm. long, 1 cm. above and 2 cm. below the arch between the tragus and the zygomatic tubercle. The trunk is dissected up to the glandular tissue, and, when this is reached, the nerve is avulsed by an extremely regular, gradual and slow traction for a distance of 3 or 4 cm. In a case of salivary fistula following an incision into Steno's duct, Leriche resected the auriculotemporal nerve, and five days after the operation the secretion ceased and the fistula closed. In a case of aerophagia caused by exaggerated salivation, Leriche resected both lingual nerves and avulsed the right auriculotemporal with excellent results; the salivary secretion was reduced, the aerophagia disappeared, and, with it, all digestive disturbances. These authors conclude that resection of the auriculotemporal nerve is a simple procedure, leading positively to suppression of the parotid secretion, that it is without danger, since it does not injure even the trunk of the inferior maxillary nerve, and that there are no untoward aftereffects, since the other salivary glands furnish sufficient moisture to the mouth, and the resulting patch of anesthesia in the temporal region is insignificant.

**Facial Paralysis.** The results of nerve anastomosis for the relief of facial paralysis have on the whole been most satisfactory, although they are not as yet ideal. In most cases, there is a return of normal tone to the muscles and of symmetry to the face in repose, and occasionally emotional expression is restored. The results seem to vary independently of whether the hypoglossal or the spinal accessory is selected for the anastomosis. Ballance[4] has reported a remarkably rapid recovery following an operation in which the proximal end of the divided hypo-

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[1] Loc. cit.   [2] Lyon, Chir., 1914, xi, 256.
[3] Ibid., p. 242.   [4] Proc. Roy. Soc. Med., 1913–14, p. 7, Clin. Sec. 33.

glossal was sutured end to end to the distal end of the facial nerve, which was severed at the stylomastoid foramen, and the proximal end of the divided descendens noni nerve sutured end to end to the distal end of the divided hypoglossal nerve. Seven months after the operation, the patient was able to smile symmetrically; all the muscles reacted to faradism, and the sense of taste returned on the affected side of the tongue. There is very little to be said in commenting upon the technic of this operation. I have found the hypoglossal the most satisfactory nerve to use as the donor, and, to obviate paralysis of the tongue, either a portion of the spinal accessory, or, as Ballance suggests, the descendens noni may be used. Success or failure depends mostly upon the nicety and the finesse with which the dissection is made, and the anastomosis effected. In Bever's[1] 2 cases improvement has been continuous. Fifteen months after the operation there was return of power to all muscles on the affected side, and the face was symmetrical in repose. Eighteen months afterward the patient could completely close the eye, *associated movements of the tongue entirely disappeared*, and the power of emotional expression was continually improving. In Welty's[2] case of anastomosis of the facial and hypoglossal nerves, the muscles had recovered their normal tonicity three years after the operation, the patient was able to close his eye, wrinkle the face, and lift the eyebrow, but the injured side of the face moved when the patient talked, and atrophy of the tongue was so marked that there was a noticeable impediment of speech.

Hunt[3] reports a case of anastomosis of the spinal accessory and the facial in which there was almost complete restoration of function one year after operation; and Beckman[4] has recently recorded 4 cases of facial paralysis with varying degrees of improvement. In all 4 cases an end-to-end suture was performed between the main trunk of the spinal accessory and the facial; and in 3 of the cases the site of anastomosis was surrounded with a fresh section of vein to prevent infection or the formation of cicatricial tissue. An inch or inch and a half section of the facial, external or anterior jugular veins is always easy to obtain, and is slipped over the spinal accessory nerve before the anastomosis is effected, and afterward this thin, cylinder-like covering may be moved down over the anastomosis. The Beckman believes is an important step in his technic.

Harty[5] has made some interesting comments on the electrical reactions in facial paralysis, especially with reference to the prognosis in post-

[1] Lancet, 1913, i, 1150.
[2] Journal American Medical Association, 1914, lxii, 612.
[3] Pan-American Surgical and Medical Journal, 1915, xx, 7.
[4] Journal Michigan State Medical Society, 1914, xiii, 681.
[5] Bristol Med. Chir., 1914, xxxii, 55.

operative cases.  The conclusions to be derived from tests on the tenth day are as follows:

| | |
|---|---|
| Loss to faradism, with reaction of degeneration  . | Recovery, apart from operation very rare. |
| Loss to faradism, with the modified reaction of incomplete division   .  .  .  .  .  .  . | Slow recovery may be foretold. |
| Loss of voluntary power, with retained power of contraction to faradism  .  .  .  .  .  . | Rapid recovery. |

The signs of reactions in cases of complete as compared with those of incomplete division are as follows:

A. Stimulation with the faradic current.

    Complete division  .   .   No response.

    Incomplete division .   .   No response, except in the mildest cases, which retain their excitability to this form of stimulation

B. Stimulation with the constant current.

    Complete division  .   .   Slow, sluggish contraction.  Polar reversal ACC > KCC.  The contraction is different to elicit and requires a stronger current than on the normal side.

    Incomplete division .   .   The contraction is sharp and brisk, as compared with that seen when the reaction of degeneration is present, but in my experience slightly more sluggish than that on the normal side.  A contraction is elicited by a weaker current than on the sound side.  No polar reversal is present, KCC > ACC.

Regarding the times of recovery in incomplete division, Harty states that in those cases which retain faradic excitability, recovery begins in two to four weeks, and proceeds rapidly, the symptoms usually appearing two or three days after the operation; while in those cases which show the typical reactions of incomplete division recovery begins in two to nine months and proceeds slowly.  It is these cases which rarely may later develop the reactions of complete division.

## THE BRAIN.

**The Therapeutic Value of Measures for the Relief of Intracranial Pressure.** The problem of increased intracranial tension is one of the most difficult and at the same time one of the most frequent with which the neurological surgeon is called upon to deal.  Formerly attempts to relieve tension were limited principally to decompressive operations of one form or another.  While in most instances decompression, particularly the subtemporal decompression, has had the desired effect, in a few cases there has been no improvement.  Occasionally if the tension is extreme and the opening was made in the motor, not in the temporal region,

the motor tracts have been injured. In all cases of increased intracranial tension of obscure origin, we should bear in mind that the increased pressure may be caused by two factors; one, and by no means the most important, is the additional volume of the lesion itself or a concomitant increase in the brain substance, such as hyperplasia or edema, the other is an accompanying internal hydrocephalus. It became quite evident to me that in those cases in which the pressure is in large measure due to the accumulation of abnormal quantities of fluid within the ventricles some method must be adopted for ventricular drainage. As a matter of routine, I have sought to determine how big a factor the internal hydrocephalus was, and before the subtemporal decompression, practised callosal puncture. The larger my experience with the combined effect of puncture and decompression, the more convinced I become of its superiority, over decompression alone. Elsberg's experience bears out the accuracy of this statement. Recently, he[1] has reported his experience with puncture of the corpus callosum in 37 cases. He states that he has "used this method thirty times instead of, or combined with, decompressive craniotomies, and in a considerable number of patients has seen great improvement follow the operation. In more than one-half of the patients, an immediate improvement occurred; the headache was relieved, the swelling of the optic nerve heads decreased and sometimes subsided entirely. In several cases, the operation was done without any anesthesia because the patients were in stupor or coma. In 2 of these, the patients became conscious and answered questions before they left the operating table. I have had one patient with advanced symptoms of a midbrain tumor so much relieved for more than six months that he was able to return to his work. The headache and swelling of the disks disappeared rapidly, and ocular palsies subsided. In almost all of the patients some improvement occurred. In the patients in whom no increase of ventricular fluid was found, there was, of course, no change in their condition, and other decompressive methods had to be resorted to." Indeed the operation has given such satisfactory results that Elsberg considers it "the operation of choice in midbrain tumors, in unlocalized intracranial growths, in subtentorial neoplasms in which a palliative operation is to be done. If the headache and the optic neuritis require a decompressive operation before the tumor can be localized, I now do a callosal puncture, and only add a subtemporal or suboccipital decompressive craniotomy either if little or no distension of the ventricles exists, or if the callosal puncture has not relieved the papilledema and the other general tumor symptoms." He has also applied this procedure in 7 cases of non-obstructive hydrocephalus with marked improvement in 2 instances.

[1] Journal Nervous and Mental Diseases, 1915, xlii, 140.

Bednarski,[1] in a recent report "On Decompression Operations in Diseases of the Optic Nerves," speaks very enthusiastically of the results of puncture of the corpus callosum. He has had occasion to have it performed on six children during the past year: Once for oxycephalia, three times for congenital hydrocephalus and twice for acquired hydrocephalus. The most striking results were those in a case of acquired hydrocephalus following a meningeal process. The vision improved after puncture of the corpus callosum from $\frac{5}{30}$ to $\frac{5}{15}$ in the right eye; in the left eye from movements of the hand to counting fingers to 4 mm., notwithstanding a pronounced optic atrophy in both eyes. The headache also disappeared. Improvement was noted in the cases of congenital hydrocephalus and oxycephalia, but the periods of observation are too short to speak of the end-results.

In many cases of increased pressure, of course, a decompressive craniectomy is still indicated, and the amelioration of symptoms for such an operation is sometimes surprising. Brade[2] reports that palliative trephining has had a very favorable influence on papilledema in the cases operated on in Tietze's clinic during the last eight years. This is particularly true in cases of fracture of the skull, and in some cases of tumors, cysts, abscesses, etc. I find that in certain cases the best results are to be obtained by combining a decompressive craniotomy with puncture of the corpus callosum. Each case presents its individual problems, but the principal fact to be borne in mind is that increased intracranial pressure may be due to a number of causes, and, whenever possible, we should aim to ascertain the underlying factors and choose our methods accordingly.

**Cerebral Decompression as a Means of Treating Spastic Paralysis.** Sharpe and Farrell[3] have recently conceived the idea of enlarging the scope of cerebral decompression by applying it in selected cases of spastic paralysis. They have already treated 65 cases in this manner, and while little more than a year has elasped since their first operation, the results have been thus far so gratifying that they strongly recommend the adoption of the procedure in all suitable cases. In their 65 cases there were 10 deaths within ten hours of the operation, 4 of the patients being under two years of age, of the extreme diplegic type and so emaciated that they were poor operative risks. Of the remaining 55 cases, all showed improvement, some to a marked degree. "Not only has there been a lessening of the spasticity of the arms and legs affected in these cases selected for operation, but there has been a definite amelioration of the mental condition of the patient to such a degree that we obtain the coöperation of the child in the carrying out of the after-treatment—

[1] Archives of Ophth., 1915, xliv, 53.

[2] Beitr. z. klin. Chir., 1914, xciii, 624.

[3] Journal American Medical Association, 1913, lxi, 1982; Journal American Medical Association, 1915, lxiv, 482.

a very important advantage of this operation." The decompression should be performed at as early a date as possible, since the longer the increased pressure continues, the worse the prognosis. According to the authors, the ideal time for the operation would be immediately after birth when only a small opening would be required to allow the escape of the subdural blood. It often happens, however, that an exact diagnosis is not made until the child is a year old or more.

Sharpe and Farrell believe the operation to be indicated in "those cases of spastic paralysis giving a history of difficult labor with or without instruments, in which, upon ophthalmoscopic examination, the definite signs of increased intracranial pressure are to be seen in the fundus of the eye; that is, only those cases of spastic paralysis which show definite signs of increased intracranial pressure, whether this condition is associated with impaired mentality or whether the size of the head is unusually small or unusually large." They do not operate, however, on the mentally deficient, the constitutionally inferior, and idiots in the hope of restoring them to a normal mentality; nor on microcephalic children in the belief that the brain will develop and become normal by enlarging their cranial capacity. They exclude cases of spastic paralysis due to a lack of development, and malformation of the cortex of the brain and the pyramidal tracts. The operation consists in a large, right subtemporal decompression. If this fails to lower the pressure sufficiently, a left subtemporal decompression is resorted to the following week. In most of the cases they found either supracortical fibrous or cystic formations caused by a cortical hemorrhage at birth. The pathological findings and the continuous improvement in the great majority of the cases upon which Sharpe and Farrell have operated, have led them to feel that this may be an effective means of treating certain cases of spastic paralysis.

That a decompressive operation may have a beneficial effect on a certain small percentage of cases of spasticity with signs of increased intracranial tension cannot be denied. As to the permanency of the improvement, it is still too soon to judge. I am fully convinced, however, that here, as in all kinds of increased intracranial tension, we would do well to determine as nearly as possible the etiological factors which are responsible for the abnormal pressure, and choose our methods accordingly, rather than be satisfied with a decompression in all cases. We know that spasticity is caused by pathological changes at some point along the corticospinal pathway. These changes may consist in porencephalus, sclerosis, encephalitis, hydrocephalus, cysts, hemorrhages into the brain substance, hematomyelia, or in defective development of the corticospinal tracts on account of premature birth or difficult labor. If a hydrocephalus, either congenital or acquired be present, let us ascertain what variety of hydrocephalus we are dealing with, and adopt the appropriate measure for its relief. If, on the other hand, the

pressure has resulted from an increase in the brain substance itself through an encephalitis, sclerosis or pseudoporencephalus, as is so often true in the acquired forms of infantile paralysis, it is very possible that a temporal decompression will relieve the intensity of the spasticity.

I can scarcely believe, however, that 70 per cent. of the cases of spastic paralysis, as stated by Sharpe and Farrell, are due to intracranial hemorrhage at birth and the lesions resulting from it. It therefore seems to me that the field of usefulness of decompression may prove to be more limited than we are led to suppose. The more I study these infantile spasticities, particularly the congenital types, the more I am inclined to believe that defective development of the corticospinal paths due to a temporary arrest of circulation at the time of difficult labor lays the foundation for future sclerotic lesions, and is responsible for the spasticity in a large number of cases. The crossed pyramidal tracts, it will be remembered, are not fully myelinated at the time of birth, and therefore have little resistance. In these cases an operation designed to relieve intracranial tension only could be of little avail. To alleviate spasticity in these cases, we must find a means of interrupting the reflex arc and lessening the sensory stimuli which act without restraint upon the muscles. For this purpose, a certain number of posterior roots may be resected, or, in the less severe and more circumscribed cases, Stoffel's peripheral resection of certain fibers may be applied. It may be that 1 in every 3 cases of spastic paralysis, as stated by Sharpe and Farrell, shows increased intracranial pressure, and in these it may be proper to lessen tension as well as diminish the sensory stimuli.

VARIATIONS IN THE TECHNIC FOR DECOMPRESSION. To obviate the necessity of removing a large area of bone, which he regards an undesirable feature of cerebral decompression, Mort[1] proposes as a substitute what he designates as a "pepper pot" trephining of the temporarily resected bone flap. A preliminary osteoplastic resection is made in the usual manner. Then, with a burr, perforations $\frac{3}{8}$ to $\frac{1}{2}$ inch in diameter are drilled at close intervals on the inner surface of the reflected flap, including only the osseous tissue. Thus is combined the advantages of temporary resection and permanent removal of bone. The bone flap is of a fenestrated, or "pepper pot," texture, capable of retaining the brain without risk of hernia, and yet with satisfactory relief from pressure.

Another method, the "lattice trephine," has been elaborated by Dreyer[2] as the result of his experiments on animals. The "lattice trephine" was devised with the hope that it would prove useful for both exploratory and decompressive purposes in those obscure brain lesions with increasing pressure. A flap of the soft tissues is reflected from half of the skull, the periosteum being left intact. A trephine opening is then

[1] Lancet, 1915, i, 66.          [2] Berl. klin. Wchnschr., 1914, li, 12.

made at the point where the lesion is supposed to be located. If nothing is found, a similar bony opening is made either to the right or the left parallel to the first one, leaving a strip of bone between the two openings. In this way practically an entire half of the brain may be inspected. If an operable tumor is revealed, one of the strips of bone may be removed. If, on the other hand, no lesion is discovered, or if an inoperable growth is found, the pressure at least is greatly lessened by means of the "lattice trephine" and some of the most distressing symptoms alleviated. The "lattice trephine," Dreyer believes, should possess all the advantages and none of the disadvantages of a large decompressing opening in the skull. The procedure has not, to my knowledge, been carried out on the living subject. Unexperienced with either of these measures, I should reserve comment until the authors demonstrate, by their clinical results, the superiority of one or the other over the established procedure—subtemporal decompression. To try to explore a large area of the brain by the Dreyer method impresses me as a reversion to antiquated procedures and without a redeeming feature. To attempt to expose a growth through a succession of peep-holes, is childish in its conception and not worthy of a serious thought. As now practised, subtemporal decompression, if combined with callosal puncture, is so eminently satisfactory in every respect, that it should be accepted without reserve as the operation of choice.

**Hydrocephalus.** As a result of my laboratory and clinical investigations, I have ventured, in a paper about to be published in the *American Journal of Children's Diseases*, to suggest as a substitute for the venerable calssification of all forms of hydrocephalus into external and internal, a new classification, which has a definite pathological and physiological basis with a direct clinical application: (1) hydrocephalus obstructivus, the type in which there is a mechanical obstruction to the natural drainage of the cerebrospinal fluid from one or more ventricles into the subarachnoid space; (2) hydrocephalus non-absorptus, in which absorption is delayed or defective as proved by the phenolsulphonephthalein test; (3) hydrocephalus hypersecretivus in which, by a process of elimination and careful consideration of the normal physiology of the cerebrospinal fluid and of the possible changes under abnormal conditions, the excessive accumulation of fluid seems to be due to a hypersecretion; (4) hydrocephalus occultus, a term, which, though paradoxical, is otherwise appropriate as designating an excess of fluid in the ventricles, the basal cysternae and sometimes throughout the subarachnoid space, concealed by the absence of any increase in the cranial dimensions. In order that some new light may be shed on this problem we should apply the tests which have been elaborated for the differentiation of these types[1] before any treatment, surgical or otherwise, is resorted to. I believe the simplest and most effective method of

[1] See PROGRESSIVE MEDICINE, March, 1915, p. 33.

dealing with hydrocephalus obstructivus is callosal puncture by which an outlet for the cerebrospinal fluid into the subarachnoid space is provided and absorption facilitated. On account of its simplicity and effectiveness, callosal puncture should supplant all other methods of ventricular drainage. In hydrocephalus non-absorptus greater difficulties are encountered; although the technic is still in a developmental stage, I venture to recommend the establishment of a drainage tract into the pleural cavity. Experimental evidence points very strongly to a retarding influence of thyroid extract upon the secretory activity of the choroid plexus, and, whenever the excessive accumulation of fluid seems to be due to a hypersecretion, I resort routinely to the administration of thyroid extract.

West[1] has attempted to establish drainage in a case of hydrocephalus, confined practically to the left lateral ventricle, by means of No. 3 twisted silk. One strand of silk passes from above and behind downward and forward to emerge in the parotid region; two others pass upward in the parietal region. The fluid began at once to pass along these strands, six months later the child's general health was excellent, and she had regained some power in the right limbs. Haynes[2] has now drained the cisterna magna into the longitudinal sinus in 12 cases, and states that while he "had been able by this method to effect drainage and in some cases to somewhat improve the contour of the child's head and to prolong life, he was by no means enthusiastic because there seemed to be little or no improvement in the mental or physical condition of these children." All but 2 of the cases, however, in which he operated were blind before treatment was undertaken. However, as Pisek says later on in the discussion, if "they had taken these cases early, made the phenolsulphonephthalein test, and employed the type of drainage that seemed indicated, the results might have been better."

V. Bokay[3] is still enthusiastic over the transparency test for demonstrating the presence of an internal hydrocephalus, the place where the brain cortex is thinnest, and where ventricular puncture or drainage may be performed with the least injury. For the treatment, however, he still advocates lumbar puncture in all cases in which the communication between the cerebral and spinal subarachnoid spaces is intact; when this is obstructed, puncture of the corpus callosum is the procedure of choice. The earlier lumbar puncture is instituted, the better will be the results, and it may be continued systematically over a period of years without untoward results, as in 1 of his cases in which fifty-one punctures were made during a period of seven years. The child's physical development was normal, the convulsions gradually diminished, and its mental state improved.

[1] British Journal Children's Diseases, 1915, xii, 171.
[2] Medical Record, 1915, lxxxvii, 751.
[3] Jahrbuch f. Kinderheilk., 1915, lxxxi, 17.

**Brain Abscess Explorer.** Because of the failure oftentimes to detect the presence of pus by means of the exploring needle or scalpel, Gifford[1] has devised a new form of brain explorer for this purpose. This instrument consists of a pair of knives, which may be introduced as one blade to any desired depth, and then spread as far apart as may be deemed wise. The handle and spring are set off from the blades at an angle of 120 degrees. If no pus escapes, the blades may be closed and inserted farther, being separated from time to time. In this way Gifford believes it impossible for pus in that particular region to escape detection. If an abscess cavity is penetrated and pus discovered, a drainage tube is introduced between the blades of the explorer. The opening in the abscess wall may be enlarged by the introduction of a bistoury. The instrument has worked most admirably in 2 cases; 1, a deeply seated frontal abscess which it would have been difficult to reach with the ordinary instruments, the other a temporosphenoidal abscess. He failed to reach the abscess in a third case, in which autopsy showed an abscess originating in the sphenoidal cavity, but very far back and close to the median line. In order to reach abscesses in the temporosphenoidal lobe through the mastoid wound, Gifford has devised an instrument similar to one just described, but with curved blades.

**Pineal Body.** Attempts are still being made to obtain a better understanding of the pineal body in health and disease by experimental extirpation of the organ and by feeding pineal extract to animals. McCord,[2] in his feeding experiments on guinea-pigs, chickens and dogs, has noted an increase in weight, together with an abnormally rapid growth of the body and precocious mental and sexual development, followed systematic administration of pineal extract. There was no tendency toward gigantism, however, and after the maximum size was attained, the extract had no effect. This somatic, mental and sexual precocity has usually been attributed to hypopinealism. Berkeley[3] has now applied this therapy to defective children in nearly 100 cases, with considerable mental improvement in most cases. Cretinism, amaurotic idiocy and congenital idiocy of long duration should be considered as contra-indications, according to Berkeley, but he believes that other low grades of mental deficiency will respond to this treatment, and he has raised the question as to whether pineal extract would not arrest or retard certain cases of premature mental breakdown. A child weighing 25 to 50 pounds should receive one or two capsules a day, the capsules being made from the fresh glands of young bullocks, which are dried and mixed with milk-sugar, one capsule corresponding to 150 pounds of bullock.

[1] Journal American Medical Association, 1915, lxiv, 2130.
[2] Ibid., 1914, lxiii, 232; ibid., 1915, lxv, 517.
[3] Medical Record, 1914, lxxxv, 513.

Dandy[1] has recently reported his results from a series of pinealectomies upon young puppies. He approaches the pineal from in front through the third ventricle rather than from behind, and thus avoids hemorrhage that would follow injury of the vein of Galen. The splenium of the corpus callosum is then divided in the midline for a distance of about 2 cm. from its posterior terminus, exposing the transparent roof of the third ventricle, which is perforated in its median line, and the opening enlarged backward to the origin of the vena Galena magna, under which lies the pineal body in the median quadrigeminal groove. Dandy's experiments have led him to the following conclusions: (1) Following the removal of the pineal I have observed no sexual precocity or indolence, no adiposity or emaciation, no somatic or mental precocity or retardation; (2) our experiments seem to have yielded nothing to sustain the view that the pineal gland has an active endocrine function of importance, either in the very young or adult dogs; (3) the pineal is apparently not essential to life and seems to have no influence upon the animal's well-being.

Until very recently the pineal body has been considered entirely inaccessible to surgical therapy. Cushing in his monograph on the pituitary body, in 1912, stated that he had approached the epiphyseal region in 2 cases without finding any neoplasm, and in PROGRESSIVE MEDICINE, March, 1914, we reviewed the two routes which had been devised by Brunner for this purpose, but it remained for Pussep[2] to perform the first operation on the pineal body. Unfortunately, the patient died three days after opening and draining the cyst, but Pussep attributes the fatal outcome to the patient's poor physical condition, rather than to the effects of the operation. The patient, a boy of ten, manifested the first symptoms nine months before the operation in the form of headache, failing vision, and defective hearing. Later, his gait became ataxic, and weakness began in the right leg and gradually extended to the other extremities; speech became difficult, and there was some vomiting. All tendon reflexes were increased, and the Babinski was marked on both sides. Muscle sense was lost in both lower extremities, and adiadochokinesis was present in the upper extremities. There was, however, no precocious development of the genital organs or of the body in general. An occipital craniotomy was performed in two sittings, the top of the arch-shaped incision being four fingers' breadth above the external occipital protuberance, and the lower extremities of the incision on a level with the tip of the mastoid process and one and a half fingers' breadth to the inner side of the latter. The bone was removed by a incision 1 cm. inside of the cutaneous incision. At the second stage, a flap of dura was reflected downward from the transverse sinus, and the occipital and right transverse sinuses were ligated. The dural opening

[1] Journal Experimental Medicine, 1915, xxii, 237.
[2] Neurol. Centralbl., 1914, xxxiii, 560.

was extended upward and to the right, toward the sagittal sinus, for a distance of 2 cm. Through an incision in the tentorium, the cyst protruded and from it two spoonfuls of reddish fluid were recovered. A part of the cyst wall was cut away and the wound closed. At autopsy the remains of a cyst-like growth of the pineal, the size of a cherry, was revealed, with marked indentation into the fourth ventricle and compression of the vermiform process.

Nasetti,[1] from his work on a cadaver, recommends a slightly different technic. He makes a very liberal opening, ligates the superior and inferior longitudinal sinuses, removes a portion of the falx, and divides the corpus callosum. Krause,[2] in his recent monograph on brain surgery, describes a technic as a means of access to the pons, the superior vermiform process, the fourth ventricle, and the pineal body.

**Surgery of the Cavernous Sinus.** Very little attention has been paid to the surgery of the cavernous sinus, chiefly because of its inaccessibility, but more especially I think, because the impression prevails that the infective thrombus inevitably extends to the sinus on the other side. This is not always the case, as I have learned from my own experience, and when it has become bilateral, if operation had been resorted to earlier, extension of the thrombus might have been arrested. During the last few years there has been a revival of interest in the surgery of this field, but thus far we have yet to find the record of a single successful operation.

The diagnosis of thrombosis of the cavernous sinus is not always easy; indeed it often happens that a correct diagnosis is not made until the thrombosis has become so extensive that all hope of recovery is gone. The ocular symptoms are the most prominent feature; they include chemosis, edema of the lids, often extending down the face, exophthalmos, proptosis, haziness and anesthesia of the cornea, and gradual involvement of the third, fourth and sixth nerves. Associated with these ocular disturbances are various cerebral symptoms in the form of headache, vomiting, exaggerated reflexes, and in the later stages there is often delirium, convulsions and coma. If the process extends to the meninges, typical signs of meningitis are observed. Chills, fever, rapid pulse and other symptoms of general systemic infection will always be present in the septic variety. The thrombus, originating in one sinus, rapidly extends to the other in most instances, and the clinical picture is reproduced on the opposite side. Occasional cases are reported, however, in which the symptoms remain unilateral for some time, as in a case recently under my observation at the University Hospital, and in Middleton's case[3] in which the symptoms were confined

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[1] Il Policlinico, Sez. Chir., 1913, xx, 497.

[2] Die allgemeine Chirurgie der Gehirnkrankheiten, Neue Deu. Chir., 1914, xii, ii Teil.

[3] Festschrift vierzigjährige Stiftungsfeier des deutschen Hospitals, New York, 1909, p. 484.

to the right side up to the time of death, nineteen days after the onset of the disease. Autopsy revealed a thrombosis of the right cavernous sinus, the left uninvolved, and a small purulent process in the left temporal lobe. But this is an unusual occurrence.

Through extension of the disease to the other sinuses, by involvement of the meninges and brain the disease is inevitably fatal. Should an attempt be made to save life by operative intervention, Ballance[1] insists that operations must be done at an early stage of the infection. In a case recently reported by him, operation was resorted to within twenty-four hours of the appearance of the symptoms, which had not yet become bilateral. He exposed the cavernous sinus by the Hartley-Krause incision for operation on the Gasserian ganglion. Upon incising the sinus for about an inch, a blood-clot and some pus escaped. The sinus was irrigated with hydrogen peroxide and a tube was inserted and fixed. The child died, however, on the second day, and autopsy showed that the left petrosal sinus was full of pus, the left cavernous sinus containing a little in its posterior end. The left half of the circular and left half of the transverse sinuses also contained septic clots, but the right cavernous sinus was entirely normal. In this case there had been a mastoid operation at which the outer wall of the sigmoid sinus had been removed and the bulb exposed. The second operation was done early enough to prevent the spread of the infection to the other cavernous sinus, but it failed to remove the infection from the inferior petrosal, which was the direct pathway between the bulb and the cavernous sinus. Ballance states that not only should the cavernous sinus "have been freely opened and drained, as was done, but the *bulb of the jugular should have been freely exposed and laid open*, so that the opening of the inferior petrosal sinus into the bulb could be seen, and *irrigation of the inferior petrosal sinus carried out from the bulb to the cavernous sinus.*" The best method of exposing the bulb, according to Ballance, is to follow the sinus until the bulb is reached; the subsequent removal of the bone to the outer side of the bulb presents very little difficulty.

Theoretically considered, the same method of approach might not be applicable in all cases. In contemplating an operation on the cavernous sinus, I can readily see the propriety of taking into consideration not only the character of the lesion—that is, whether a foreign body, an aseptic or infective thrombus—but, if we are dealing with an infective thrombus, what the source and extent of the infection.

Streissler,[2] in his recent and very excellent paper on surgery of the cavernous sinus, has come to the conclusion that an intracranial route, preferably the temporal, is indicated in cases of trauma and all aseptic

[1] Internat. Otolog. Congress, Trans., ix,. 308.
[2] Arch. f. klin. Chir., 1914, cvi, 48.

conditions, while in cases of a septic nature, in order to avoid infection of the meninges and to facilitate adequate drainage, a transphenoidal route is the procedure of choice. He reports a case in which he removed a bullet from the cavernous sinus under local anesthesia according to Lexer's sphenotemporal method of approaching the Gasserian ganglion, with the exception that instead of proceeding extradurally as far as the cavum Meckelii, he incised the dura in the region of the foramen ovale and rotundum, raised the anterior end of the temporal lobe and proceeded intradurally to the lateral wall of the sella turcica. After the separation of an adhesion between the temporal lobe and the cavernous sinus, a small hole was revealed in the wall of the sinus about ½ cm. from its upper border. The brain was raised gently, the hole enlarged, and the bullet withdrawn. The hole in the wall of the sinus was closed with a small tampon. The patient made an uneventful recovery, and was discharged cured eight weeks after the operation. Several years ago I had occasion to operate upon a patient with a bullet lodged in the base of the skull not far from the cavernous sinus. In this case I followed a technic which I have used in some pituitary cases, a transfrontal craniotomy, and succeeded in elevating the frontal lobe sufficiently to give me ready access to the bullet. Voss[1] and Küttner[2] have operated according to the Lexer route, but in both cases Voss varied the operation by introducing Krönlein's modification in his approach to the orbit. Voss's patient died from a preëxisting meningitis, and Küttner's patient lived but a few weeks.

The Hartley-Krause method of approaching the Gasserian ganglion was adopted by Dwight and by Hartley in the first two operations for thrombosis of the cavernous sinus,[3] and it has since been slightly modified by Ballance.

The question has arisen of late as to whether it would be proper, in cases of infective thrombosis, to remove the contents of the orbit. This would involve resection of the posterior portion of the bony wall of the orbit up to the optic foramen, and after resection of the anterior and outer borders of the sphenoidal sinus the cavernous sinus comes into view. Such a procedure has been carefully worked out on a cadaver by Levinger,[4] but he has never, to my knowledge, applied it on the living subject.

Mosher has come to the conclusion that "the approach to the cavernous sinus through the orbit is the direct and natural way." He does not consider the removal of the eye a serious obstacle, since the eye is already useless in serious cases. After one failure to reach the cavernous sinus in this manner, because he had gone too high and opened the roof of the orbit in front of the lesser wing of the sphenoid

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[1] Ztschr. f. Ohrenheilk., 1907, liii     [2] Chirurgie des Kopfes, 1913, p. 306.
[3] These cases were fully reviewed in PROGRESSIVE MEDICINE, March, 1903.
[4] Ztschr. f. Ohrenheilk., 1912, lxv-lxvi, 10.

and above the cavernous sinus, Mosher continued his studies on the cadaver, and elaborated the following technic:

The orbital contents are removed, the ophthalmic artery tied, and the periosteum removed from the floor of the orbit. A vertical incision is then made through the orbital plate of the great wing of the sphenoid from the notch for the superior maxillary nerve below to the outer end of the sphenoidal fissure above, and the bony opening enlarged outward ½ cm., the lower edge of this opening being flush with the floor of the orbit. At this juncture the dura is raised from the floor of the middle fossa and separated from the outer wall of the cavernous sinus for about 1 cm. A blunt-pointed knife is placed against the outer wall of the sinus on a level with the floor of the orbit, and the blade is directed toward the sphenoid. In this way an opening is made in the wall of the sinus through which a curette may be introduced.

The selection of the route depends entirely upon the portion of the sinus which one wishes to expose. Theoretically at least, the orbital approach is distinctly contra-indicated in some cases of infective thrombosis. By this route it is possible to reach only the anterior aspect of the cavernous sinus so that it would be entirely ineffective in cases in which the infection has spread from the bulb or the inferior petrosal sinus, as in Ballance's case, to the posterior portion of the cavernous sinus. Where an approach must be had to the posterior end of the sinus, the temporal route would seem to be indicated, and, if the disease has extended from the bulb, Ballance's suggestion may be tried. Whether, as Streissler proposes, the various transphenoidal routes for pituitary exposure can be applied to the exposure of the cavernous sinus, I am not prepared to say. We are yet on the threshold of cavernous sinus surgery; credit must be given those who are paving the way for greater accomplisments. Judgment must be reserved until the era of speculation and repeated failures has passed into one of substantial results.

**Hemostasis in Cranial Surgery.** I think I have tried and discarded all the devises for the control of hemorrhage from the scalp in craniotomies: The Heidenhain and the Kredel suture, the back-stitch suture of Makkas and Vorschutz, the pneumatic and the rubber tourniquet. Landon's metallic tourniquet, is the most effective of all and the only one I can recommend to those who rely on this means of hemostasis. The prompt application of hemostats as each limb of the incision is made to the aponeurotic layer of the scalp, everts the edges of the wound, and by direct and indirect compression controls bleeding absolutely throughout the operation. Thus the difficulty of applying and adjusting the tourniquet or the time consumed in introducing the sutures is avoided. But the matter of hemostasis still holds the attention of surgeons, and from time to time new methods are introduced, and of these a few will be reviewed.

Freidman's[1] device is a hemostatic safety pin, which may be applied to any region of the skull for the control of hemorrhage either in an osteoplastic resection or a subtemporal decompression. These pins, which resemble ordinary safety pins except that there is a middle bar which is controlled by screws passing through the upper cross-piece so that pressure may readily be exerted against the scalp, are strong but light in construction. Friedman advises that when the pin is introduced the bone be closely hugged so that it will include the entire scalp. The exit and closure of the pin is facilitated by pressing upon the skin at that point with an artery clamp or scissors. The pin is introduced before any incision is made and at a distance of one-half to three-quarters of an inch from the proposed line of incision, and it should be left *in situ* until the scalp is sutured and the visible vessels tied. These are in two sizes, the larger measuring $4\frac{1}{2}$ inches, the smaller, $2\frac{1}{2}$ inches in length. The smaller ones are used for the corners left unguarded by the larger pins on account of the convexity of the skull.

The control of bleeding from the brain itself presents another problem. The application of a muscle graft to a small bleeding-point, proposed by Horsley, many years ago, in my hands has proved most effective. To prove the effectiveness of living tissue as a hemostatic, Horsley[2] conducted a series of experiments and found that a sliver of the animal's own muscle possessed all the requisites, namely, asepticity, adhesiveness, thrombokinesis. By gently pressing the bleeding-point with gauze and immediately applying a piece of living muscle with pressure for fifteen to twenty seconds, it was observed that the muscle fragment closely adhered to the vessel. This adhesive quality varies naturally with the pressure of the escaping blood. Applied to a divided artery in the cat and dog the muscle graft would resist as much as 60 to 80 mm. Hg. blood-pressure. Fascia proved to be very unsatisfactory for this purpose since it did not possess the necessary amount of adhesiveness.

During the past year, an attempt has been made by Cushing and Grey[3] to find an absorbable material which might be used for hemostasis in cranial surgery in place of cotton or the living muscle tissue, and it was found that fibrin from sheep's blood met most of the necessary requirements. In his experiments, Grey demonstrated that fibrin "possesses all the hemostatic qualities of cotton wet with salt solution and has the advantage that it is absorbed with comparatively slight reaction on the part of the surrounding tissues." Two series of experiments were conducted, one to test the hemostatic qualities of the fibrin, the other to determine the reaction on the part of the surrounding tissues. In the first series it was found that the fibrin, when dipped into a physiological salt solution and pressed against bleeding-points

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[1] Surgery, Gynecology and Obstetrics, 1915, xx, 182.
[2] British Medical Journal, 1914, Part ii, p. 8.
[3] Grey, Surgery, Gynecology and Obstetrics, 1915, xxi, 452.

with a sponge, was more effective than wet cotton in controlling the hemorrhage, as it adhered to the vessel more firmly.  To facilitate clotting, the fibrin may be dipped in Kocher-Fonio coagulin or a similar solution, and to prevent dislodgement of the fibrin when the gauze is removed, a sheet of protective rubber tissue is wrapped about a ball or finger-shaped piece of dry cotton and the edges secured with a thread. By using this as an applicator, sufficient pressure may be used without danger of pulling the fibrin away.  In the second series the absorption of small pieces of fibrin was compared with that of autotransplants, and it was found that with the latter the reaction of the cerebral tissues was much more marked.

**A New Method of Removing Hair from the Scalp.**  Haberland[1] recommends the use of barium sulphate for removing hair from the field of operation.  This method he believes to be far superior to shaving in that it requires much less time—approximately three minutes against ten or fifteen for shaving—and does not injure the scalp.  The single disadvantage is its very strong odor, but this may be counteracted by attar of roses or cumarin.  A solution of barium sulphate is prepared and applied either with a stiff brush or the hand to the area from which the hair is to be removed.  After two or three minutes the hair is wiped off, the scalp washed with soap and water and dried.  Haberland has used this method frequently in experimental work and strongly recommends its adoption in cranial surgery.  No injury of the roots results, and after the application of hair restorers, the hair grows again almost immediately.

**Traumatic Cerebral Lesions.**  Of all intracranial lesions, those which follow trauma were the earliest to receive consideration, and yet today there is by no means an unanimity of opinion as to how they are brought about and how they are to be treated.  Witness the discussions and the theories upon the physics of fractures, the endless dissertations upon the nature of concussion, and the disputes as to the indications for operation in basal fractures.  To be sure we have come to a better understanding of the pathology of cerebral contusion and its accompanying edema, we have a thorough knowledge of the problems of intracranial tension, as they affect the symptoms and treatment of traumatic lesions, and the x-rays have been of great value in clearing up disputed points in diagnosis.  But we still have much to learn.

I commend the reader to the excellent monograph of Trotter[2] for its presentation of the pathology and treatment of cranial injuries. In the first place, he reminds us that the brain is enclosed within a membranous and a bony capsule which is "absolutely inextensible by any physiological force," and the whole of the contained space is indispensable for the maintenance of normal function.  A complete understanding of these facts is, as Trotter asserts, the foundation of intra-

[1] Zentralbl. f. Chir., 1914, xli, 673.        [2] British Journal Surgery, 1915, ii, 520.

cranial pathology. The intracranial space may be encroached upon by hemorrhage, by a bullet, or by a deformation of the skull through direct violence. As to the deformation of the skull, it should be borne in mind that the skull possesses a high degree of elasticity so that it is often able to recover its normal contour after great stress. Skulls also, as Trotter points out, vary greatly in resilience, so that the degree of fissuring cannot be taken as a criterion for the amount of deformation and injury to the brain. The greater the departure from the spherical shape, however, the greater the encroachment upon the intracranial space.

Concerning the forms of injury to which the brain is susceptible, Trotter conveniently sums up for us the effects of deformation of the skull by external violence in the following table:

1. The generalized component causing hyperacute compression:
    (a) General cerebral anemia—"concussion."
    (b) Displacement of cerebrospinal fluid—central contusion.
2. The direct component striking upon the underlying brain:
    (a) Direct contusion (or laceration).
    (b) Polar contusion—contusion by contrecoup.
    (c) Contusion of the cerebral substance.

The injuries associated with localized fracture, he gives in the following statements:

1. When the area of impact is so small as to cause a localized fracture in the adult, the scalp is almost always laid open. It is almost invariably true that in adults all depressed fractures are compound.

2. With a small entrance wound, the extent of the damage to the brain is very likely to be underestimated owing to the relative absence of concussion symptoms.

3. In cases with extensive injury of scalp and skull, with perhaps wide exposure of the brain, the prognosis is always better than the extremely ugly appearance of the wound would indicate, because of the absence of contracoup contusion and other distant lesions.

Intracranial injuries, according to Trotter, may manifest themselves in three ways: namely, by direct destruction of cerebral tissue caused principally by bullet wounds; by reactionary swelling or edema which accompanies all contusions or lacerations and in a lesser degree the hyperacute compression which is the pathological basis of concussion of the brain; and by hemorrhage. The compression brought about by the reactionary edema, which is usually mild and widespread, causes venous obstruction and consequent increased excitability of the brain; it is therefore one of the "conditions in which a purely decompressive operation may be called for after a head injury."

Turning to the clinical manifestations of cranial injuries and their treatment, Trotter divides them into the following groups:

1. Cases of obviously grave and wide-spread compression of the hemisphere, marked by coma and hemplegic signs, and associated with

signs of basal fracture or with the graver bullet wounds. In this group, as soon as a diagnosis of hemispheral compression can be made, operation should be undertaken. A large flap should be turned down over the temporal region. It is not generally desirable to make a bone-flap, as the procedure lengthens the operation and increases the loss of blood. An opening is made in the temporal fossa. An extradural hematoma can be evacuated through a relatively small opening $1\frac{1}{2}$ or 2 inches square. The clot should be removed by gentle irrigation. It is always desirable to incise the dura to see if there is intradural bleeding or increased intracranial tension. If the hematoma is intradural, a larger bone opening is generally necessary. If, after the clot has been evacuated the brain bulges strongly into the opening, a definite decompression is necessary, and the bone may be removed until there is a gap of 3 x 4 inches. Such bulging is apt to occur if a large hemorrhage has been allowed to accumulate for several days. Failure to provide for decompression may be fatal under such circumstances. Drainage is not usually necessary, and the dura should never be sutured.

2. Cases of grave injury, usually with coma, but without localizing signs. In the absence of focal symptoms, direct treatment is impossible. "If the coma should become profound or be persistent for several days or even weeks, that in itself constitutes a localizing symptom of pressure in the superior chamber and should be met by a temporal decompression. In such a case, usually nothing but marked increase of tension is found, but occasionally an otherwise symptomless hemorrhage is encountered. The result of such treatment is usually very satisfactory."

3. Cases which present mainly irritative signs. In cases with extreme mental excitement, it is usually necessary to wait for paralytic phenomenon. If, however, a diagnosis of subdural hemorrhage is possible, one should intervene at once. In cases manifesting signs of the classical cerebral irritation, temporal decompression is usually indicated to hasten the subsidence of the edema, and to prevent the various untoward sequelæ which invariably follow a slow spontaneous recovery.

4. Cases presenting signs of a localized cerebral lesion but no evidence of wide-spread grave disturbance. As soon as the hemorrhage is located, operation should be undertaken at once.

5. Cases of localized injury of the skull and brain due to direct violence—compound depressed fractures—usually with very few if any physical signs of actual brain injury, though such is often obviously present—cases for the most part of injuries by bullets, etc. "All of these cases demand primary surgical interference, whether they display cerebral symptoms or not."

**Fractures.** Although *fractures of the vault* as a group, are not considered as grave as fractures of the base, Anderson[1] reports that out

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[1] Surgery, Gynecology and Obstetrics, 1914, xviii, 522.

of 72 cases of fracture of the vault at the Cook County Hospital in 1912, only 26 recovered, a mortality of 64 per cent. The determination when to and when not to operate in cases of fracture of the vault admits of little discussion. All compound fractures, all cases of depressed fracture except the trivial fractures of the internal table requires surgical attention. In dealing with the fragments of a comminuted fracture permit me to protest against a very common practise of throwing away these fragments. This, it seems to me, is almost a universal practise, and is to be condemned. If, upon the elevation of the fragments, the latter become altogether detached, or if they were detached on first inspection, they should be thoroughly cleansed in warm saline solution, broken up in smaller fragments and immediately reimplanted; and, unless the wound becomes infected, the grafted fragments will heal in kindly, as they do in 90 per cent. of my cases, and the patient will recover without a cranial defect. I feel very strongly on this point because I have been called upon so often to repair old defects which might have been repaired at the time of the accident, and the patient thus saved a second operation.

The more serious forms of cerebral contusion are almost invariably associated with *fractures of the base* of the skull, or to put it in another way, basal fractures are frequently associated with cerebral contusion. These are usually bursting fractures, and the indications for treatment are entirely different from those of depressed fractures of the vault. With basal fractures it is a question of how best to deal with the increased intracranial tension and the rapidly diffusing edema, which encroaches soon upon the vital centres. In discussing the operative treatment of basal fractures it is my custom to divide the cases into four groups: (1) Those in which the injury is so slight that recovery is certain without operation; (2) those in which the damage to the brain has been so great that death is unavoidable in a short time, a rapidly rising temperature being always indicative of a serious central lesion; (3) those in which the condition, while serious, does not threaten life. There may be complete unconsciousness, even deep somnolence, the slow, full pulse, and the respiratory arhythmia of medullary pressure, and other concomitant symptoms. The complete clinical picture may not have reached its maximum intensity for twenty-four to forty-eight hours; in the next twenty-four to forty-eight hours the condition remains unchanged to be followed by gradual restoration of consciousness and the subsidence of signs of pressure; (4) in this group the patient survives the immediate period of shock; the symptoms of intracranial tension develop; and while the condition at first is not desperate, it becomes progressively more serious, and there are signs of beginning breakdown of the respiratory and circulatory functions.

Certainly, in groups 1 and 2 (the very mild and the inevitably fatal), operative intervention is clearly not indicated. In group 3,

where there is a more prolouged stage of unconsciousness with delirium, there are some who say that decompression, while not of necessity a life-saving procedure, shortens the convalescence and minimizes the chances of serious sequelæ. While there may be some justification for this statement in the experience of others, it is not corroborated by my own observations; and, from what we know of the diffuse nature of the lesion in cerebral contusion, I do not understand how the establishment of a subtemporal opening could have any beneficent influence over the minute hemorrhages, lacerations and edema which characterize the lesion and which are more or less wide-spread. Subtemporal decompression will, I grant you, relieve pressure, though only to a limited degree, but it could hardly promote absorption of the hemorrhagic foci or prevent the damage of cicatrization that follows in the ordinary course of the process of repair.

In the final analysis, subtemporal decompression should be regarded as imperative only in the last group, where there is danger that the increasing tension will overwhelm the vital centres, and in this group will be found but a small percentage of the total number of cases.

Long,[1] in a recent article on brain injuries, has divided basal fractures into five somewhat similar groups, and his indications for operation are as follows:

Group I. Mild concussion, blood-pressure and pulse practically normal. This group should be treated by rest in bed, head elevated, ice-cap, etc.

Group II. Delirium present, which may or may not mean brain laceration, pulse and blood-pressure within normal limits. The treatment should be similar to group I unless the blood-pressure begins to rise or stupor follows delirium, when operation should be resorted to at once.

Group III. Comatose, blood-pressure and pulse within normal limits, therefore sufficient traumatism to depress the cortex, but not sufficient to depress the vital centres to such a degree that they do not respond somewhat to rising intracranial pressure. These patients would have a wider margin of safety if decompressed immediately.

Group IV. Comatose, blood-pressure high, pulse slow, therefore a high intracranial pressure already developed to which the vital centres are responding, but we have no means of knowing how much further they are capable of raising the blood-pressure, and an hour after injury, it points conclusively to a rapidly increasing pressure which demands *instant* decompression.

Group V. Comatose, blood-pressure low, pulse rapid and feeble. For good operative statistics this group should be let alone. A trephine opening and insertion of rubber tissue drain in both temporal regions

[1] Long Island Medical Journal, 1914, viii, 54.

permits drainage and lessens the compression in those cases in which hemorrhage is the fatal factor, and hastens the death of those in which shock is the fatal cause, although Long believes that this can be done with little additional shock and should be done, as the possible benefit is greater than the possible damage.

From 1908 to 1911 there were 29 cases of basal fractures at the Brooklyn Hospital with 14 deaths, as will be seen in the accompanying table compiled from Long's statistics:

|  | Total number. | Recovered. | Died. | Mortality-rate. |
|---|---|---|---|---|
| Group I | 5 | 5 | 0 | 0.0 |
| Group II | 6 | 4 | 2 | 66.6 |
| Group III | 7 | 4 | 3 | 42.8 |
| Group IV | 2 | 0 | 2 | 100.0 |
| Group V | 9 | 2 | 7 | 77.7 |
| Total | 29 | 15 | 14 | 48.2 |

In the serious cases, including the fatal ones, Long believes the operation, if performed at all, was too long deferred. He has never seen a death caused by operation, and many in shich prompt decompression would have preserved life. Out of the 14 fatal cases, 13 died within twelve hours of the injury; hence the necessity of intervening early, if at all. According to my classification many of these belong to the "inevitably fatal."

Blair[1] has been studying the effects of subtemporal drainage upon unlocalized intracranial injuries and comes out boldly with instructions "to open *every* skull subtemporally of *every* patient seen early with supposed unlocalized brain injury." How many will follow the instruction implicity? On his service at the St. Louis City Hospital during 1910 and 1912 there were 42 cases in which a single or bilateral subtemporal operation was done for *severe* (What constitutes severe?) *unlocalized* intracranial injury. The results in this series of 42 operated cases were compared with a series of 63 patients not operated upon and living beyond a two-hour limit (Why exclude in his mortality statistics those dying within two hours?), and the effect of the operation noted, particularly if resorted to early.

|  | Operated. | Unoperated. |
|---|---|---|
| 1. Percentage of recoveries | 57 per cent. | 55 per cent. |
| 2. Percentage of recoveries, patients surviving twenty-four hours | 75 " | 5 " |
| 3. Percentage of recoveries, patients surviving forty-eight hours | 75 " | 75 " |

As a commentary upon this table merely as a statement of figures, I call attention to the fact that in the third group as many patients recovered without operation as did with. In other words, this group

[1] Jour. Amer. Med. Assn., 1914, lxiii, 863.

included a number of mild cases in which the operation was not required as a life-saving procedure, and therefore uncalled for. Many of these cases belong to groups 1 or 3 of my classification. Secondly, that eliminating from his table all cases that died within two hours, he thereby gets a higher percentage of recoveries following operation than if these were included; assuming his dictum—that *every* skull of *every* patient should be opened at once—be strictly adhered to.

Regarding the time for operation, Blair found that in half of the successful cases, but in only one-third of the fatal cases, the operation had been done within two hours. Of the patients on whom operation was performed within two hours, 70 per cent. survived. An attempt was made to substantiate these conclusions by physiological investigations, but without great success, as the elasticity of the skull and the size of the brain is so different in animals. In the animals surviving the concussion injury long enough, an immediate opening was made in the skull and dura, and the autopsy findings in these animsls were compared with those in animals who had sustained a similar injury, but upon whom no decompressive operation was performed. It was found that animals in the latter group who had been struck upon the vertex usually presented a basal clot around the cisterna magna and the interpeduncular space, enveloping the pons and medulla, while in animals of the former group who had been struck in the same manner, the clot was "either absent or at least absent on the side that was drained."

FRACTURE CONFINED TO THE PETROUS PORTION OF THE TEMFORAL BONE. Gleason and Pfahler[1] have recently reported a case in which the röntgenogram showed a fracture confined to the petrous portion of the temporal bone. While there have been occasional cases in which a fracture of the base of the skull extended through the petrous portion of the temporal bone, this seems to be the first case in which an isolated fracture of this portion of the temporal bone has been diagnosed by the röntgenogram. The value of a careful Röntgen examination in such cases can scarcely be overestimated; indeed it may be that many obscure cases of deafness and facial paralysis following trauma are to be explained in this manner. The authors urge the use of small diaphragms which will limit the field of investigation and give clearer definition and a more certain diagnosis. They believe that it should be possible to diagnose most, if not all, fractures of the skull by means of the röntgenogram, and the sooner after the injury the examination is made the clearer will be the line of fracture, although Grashey's experience has shown that it is often possible to demonstrate the line of fracture even after two years.

**Repair of Defects in the Skull.** The importance of the early repair of traumatic defects in the skull as a result of accidents in civil life

[1] American Journal of Roentgen., 1915, ii, 604.

has been recognized for some time, the question is now brought to our attention with relation to head injuries in the present war. Orth[1] after reporting the death of four soldiers with large cranial defects from meningitis, comes to the conclusion that "all grave cranial defects which have led to a prolapse of the brain should be covered at once to prevent the possibility of hemorrhage and infection." In 1 of these cases, Orth attempted an osteoplastic repair of the defect, but it was too late, and the man died from meningitis on the fourth day. He feels, however, that the operation is possible in the field under light ether anesthesia, and that it should be carried out at once in order that infection may be prevented.

In regard to the method of closing the defect, I have used, almost routinely, the König-Müller procedure with uniform success, although in a few cases I have made use of the blade of the scapula, with periosteum on both sides. It has been my experience that by far the best results are to be obtained by one of these methods, and I give them preference over any of the heteroplastic or homoplastic procedures. Müller[2] has recently obtained very satisfactory results in 2 cases cranial defects by transplanting a small fragment from the sternum. He believes that this bone possesses certain advantages over other bones which have been utilized for this purpose in that in addition to being very accessible, it is soft and spongy in consistency, so that a fragment a few millimeters thick may be removed without difficulty. moreover, in cases in which the defect involves the dura as well as the skull, a bit of fatty tissue may be removed with the sternum to fill in the gap in the dura. There is but on disadvantage, namely, the narrowness of the sternum which makes it unsuitable for large defects. Müller suggests a plan I have found very useful, of cutting a piece of sterile material the exact size of the cranial defect and using this as a guide in shaping the fragment of bone taken from the sternum.

Morris[3] has recently reported the successful repair of a cranial defect by means of an osteoplastic graft from the tibia. At the operation the dural adhesions were loosened, the scar tissue excised from the cortical area, and before the tibial graft was fixed in place, cargile membrane was introduced to prevent the recurrence of adhesions. Nine months after the operation the graft had remained firmly in place and the patient had had no return of the epileptic attacks. Great care must be exercised in removing the transplant from the tibia, as has been emphasized by another of Morris's[4] cases in which after the repair of a defect, measuring $1\frac{1}{4}$ x $1\frac{1}{8}$ in., with a graft from the tibia there was a fracture of the tibia. Morris states that he has heard of 4 other cases in which there was a similar sequence of events. Mauclaire's[5] experience with

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[1] Med. Klinik, 1915, xi, 10.    [2] Zentralbl. f. Chir., 1915, xlii, 409.
[3] Annals Surgery, 1915, lxi, 740.    [4] Ibid., 1913, lvii, 690.
[5] Archives gén. de Chir., 1914, viii, 301.

the autoplastic method in 3 recent cases has led him to the conclusion that the bony transplant should be given preference over both the osteoplastic procedures and the heteroplastic methods. In 1 case he employed the lower angle of the scapula, but the graft did not entirely fill the gap and had to be removed because of a fistula. In the other 2 cases in which a fragment from the great trochanter was used, the results were entirely satisfactory; in 1 of these cases a simultaneous dural defect was repaired with a hernial sac. Küttner[1] has employed a fragment from the scapula to repair a cranial defect in 2 cases with good results. He feels, however, that resection of the scapula is not to be treated lightly, as it is often some time before function of the arm is entirely restored.

While autoplastic methods are to be preferred in most instances, there are cases where the defect is so large that it seems necessary, Funke[2] believes, to resort to one of the heteroplastic methods. The celluloid plate may be used for temporary closure of a defect, but Funke's experience seems to indicate that it is not effective for permanent repair. In 1 of his cases, though the plate had stayed in place eleven years, it lost its firmness and elasticity, and a fistula formed which necessitated its removal. Funke believes that juvelit, a product made by Pollak, of Vienna, from phenol and formaldehyde, should prove a satisfactory substitute for celluloid, since it possesses the same consistency and elasticity, is insoluble, sterile, and easily disinfected, and he intends to use it in the future when a heteroplastic method is indicated. Ruppert[3] prefers celluloid plates to other heteroplastic materials, such as metal and ivory plates, and believes that all large defects should be repaired in that manner.

From the surgical reports[4] of the present war, we learn that cranial defects may be satisfactorily closed with metal capsules. Such a method has the double advantage, in that it may be used for large defects, and the material is always available in a field hospital. How permanent the results will be remains to be seen.

**Hypophysis.** It must be remembered that in spite of the constantly increasing number of operations upon the hypophysis we are still in the developmental stage of pituitary surgery; the opinions held today may be quite different from those of tomorrow. We are hampered first by the complexity and lack of uniformity in the clinical manifestations of pituitary disorders, and secondly by the limited opportunities thus far afforded for studying the morbid anatomy of these lesions, either on the operating table or postmortem, and hence of making definite correlations between the various pathological conditions and their

[1] Centralbl. f. Chir., xl, 1487.  [2] Ibid., 1915, xlii, 257.
[3] Wien. klin. Wchnschr., 1914, xxviii, 30.
[4] Blegvad, München. med. Wchnschr., 1915, lxii, 1065; and Duval, Bull. et Mém. de la Soc. de Chir., 1915, xli, 1228.

clinical manifestations. Shall one try the effect of glandular therapy, or shall one resort to a palliative or a radical operation, and if the latter, how shall the gland be approached?

Only in the presence of symptoms indicative of hypofunction, such as adiposity, dwarfism, drowsiness, polyuria and sexual disturbances, particularly amenorrhea and impotence, is glandular therapy especially indicated. In my personal experience I have found glandular feeding of value in but a few instances; indeed I advocate it with much hesitation and apprehension for fear that operation may be too long deferred.

Granted the ineffectiveness of glandular feeding in some cases, and its impropriety in others, under what conditions should we have recourse to surgery? The mere acquisition of fat, believed to be an evidence of hypofunction of the posterior lobe, would of itself scarcely be considered, it seems to me, an indication for surgical interference. Similarly one might speak of sexual impotence, amenorrhea, or even acromegaly, which is often a self-limited disease. Those symptoms due to increase in general pressure, such as headache and ocular disturbances, form the principle indication for surgical intervention. The method of procedure in these cases depends primarily upon whether we are dealing with a supra- or an endosellar lesion. If a suprasellar tumor be unattended with enlargement of the sella turcica, naturally a sella decompression would have little influence upon the condition.

In my earliest surgical experience with pituitary disease, I advocated the *transfrontal approach* to the sella turcica, and devised a technic which made the sella safely accessible. Of the first 8 operations by this technic, in 3 I found lesions, the nature of which was such that they could only have been recognized by this route. One was a pituitary cyst, successfully evacuated, 1 a tumor of the middle fossa as large as a plum, probably an endothelioma, and the third a large endothelioma, taking its origin from the optic nerve. In 2 of the 8 cases following partial removal of the sella contents, there was either little relief or recurrence of symptoms, and resort was had later to a transphenoidal hypophyseotomy. This experience led me for the time being to abandon the transfrontal procedure until the time comes when we may be able to recognize clinically the presence of a cyst that could only be evacuated by this route, or of an extra-sellar tumor that has not reached the inoperable stage. A slightly different method for reaching the hypophysis intracranially has recently been devised by Heuer.[1] He reflects a large, low frontal osteoplastic flap, then opens the dura almost as widely. At this juncture a lumbar puncture is performed, the head tilted backward and by gravity the frontal lobe falls away. For a larger exposure, the brain may be retracted by laterally introducing a spatula in front of the temporal lobe. The procedure has been carried out in 2 cases with satisfactory operative

[1] Johns Hopkins Hospital Bulletin, 1915, xxvi, 54.

results. In the case of a boy of ten, with complete blindness in one eye, hemianopsia in the other, and increasing headache, a large, bluish cyst protruded above and between the optic nerves at operation. This was opened and a large amount of blood-stained fluid evacuated. There was marked improvement for six months, at the end of which time the symptoms gradually returned and there was considerable accession of fat. In the second case a cyst was found behind the optic chiasm, probably taking its origin from the infundibulum.

The surgery of pituitary lesions in my clinic has resolved itself largely into the invasion of the sella turcica by the *transphenoidal endonasal route*. We have resorted to this operation routinely for the past two years and have found it reasonably safe. By this method we have succeeded not only in improving vision, but in relieving headache and vomiting. Sometimes the improvement in vision has been striking, beginning often within a few hours of the operation. Sufficient time has not elapsed to observe the influence of the relief of pressure following sella decompression upon such distinctly glandular disturbances as have to do with the sexual sphere and with disturbances of metabolism. In some cases glandular therapy has been instituted after the operation. Whether or not we are to be satisfied with a simple sellar decompression, or to proceed to the removal of the tumor, depends upon the conditions found. When the pituitary body is flattened out aginst the floor of the sella, a condition we have not yet recognized, the impropriety of proceeding further is self-evident. In other cases as much of the tumor as is available is extirpated. Our practise has been distinctly conservative, and I doubt whether, in the absence of conditions threatening life, we should launch forth on too radical a course. The benignity of many pituitary lesions, and the comparative benignity of many malignant growths of the pituitary, may be offered as an argument in favor of conservative practise.

Stein[1] has recently reported a case in which there was marked improvement of all general symptoms two months after a sellar decompression, according to Hirsch's technic, and he very strongly advocates this method. Ranzi[2] has lately put on record the twenty-first case operated upon by v. Eiselsberg and himself according to the Schloffer method; of these, there have been 4 deaths from meningitis. In the case just reported, hypophysectomy was followed by improvement in vision and retrogression of the acromegalic symptoms. In a case operated on by Anschütz[3] according to the Schloffer method, there was considerable improvement in the glandular symptoms nine months after hypophysectomy. The pathological diagnosis was tuberculosis with evidences of adenomatous changes in some places and hyperplasia in others.

[1] Laryngoscope, 1915, xxv, 159.    [2] Wien. klin. Wchnschr., 1915, xxviii, 133.
[3] Verhandl. d. deutsch. Gesellsch. f. Chir., 1914, xliii, 99, Teil I.

In Schepelmann's[1] cases there was marked improvement in vision three months after hypophysectomy.

For the relief of subjective disturbances of intracranial tension, temporal decompression naturally suggests itself, but the operation has been singularly ineffective. In 1 of my cases, headache was the most disturbing symptom, but a decompression failed to afford the slightest relief. This may be attributed to the fact that the tension of the dural capsule of the enlarged gland is uninfluenced by a subtemporal opening.

When there is an associated hydrocephalus, puncture of the corpus callosum will measurably relieve the symptoms of intracranial pressure. In 2 of my cases, dilatation of the ventricles was a conspicuous feature, and in 1 of these, headache has been relieved, and optic atrophy arrested by callosal puncture. The condition was recognized before the operation by the atrophy of the inner table of the skull, and flattening of the convolutions, as revealed in the röntgenogram. Leszynsky[2] has recently reported a case in which puncture of the corpus callosum and the withdrawal of 60 c.c. of cerebrospinal fluid was followed by almost immediate improvement of all the signs of general pressure—headache, ocular disturbances, vertigo, vomiting, exaggerated reflexes—but the objective signs of hypopituitarism, such as hypotrichosis, infantile genitalia and obesity, remained unchanged. One year after the operation, none of the signs of hypertension had returned.

**Lumbar Puncture in Wounds of the Head.** Until recently, lumbar puncture has been used very little in cranial trauma. This is particularly surprising when one considers its value as an aid in diagnosis and prognosis as well as for therapeutic purposes. Many cases of both extra- and intradural hemorrhage have been allowed to die unrecognized which would have been readily revealed by lumbar puncture—50 per cent. according to v. Bruns's statistics. Hosemann[3] has recently reported that lumbar puncture has been employed for cranial and spinal trauma in Müller's Klinik in Rostock for the last six years. They have found that early puncture, in addition to its diagnostic value, often has a curative effect. It facilitates the resorption of extravasations of blood, allays meningeal exudates, and is of no little value in clearing the mind and shortening the period of unconsciousness. This was particularly true in 2 cases in which the röntgenogram showed no fracture, but in which the clinical picture and the bloody fluid recovered at puncture indicated a severe contusion of the brain.

Experience in the present war is proving that lumbar puncture holds a place of importance in the treatment of head injuries both as a diagnostic and as a therapeutic measure. Baumel[4] has made careful chemical and cytological examinations of 90 specimens of cerebrospinal fluid in

[1] Deutsch. Ztschr. f. Chir., 1915, cxxxiii, 390.
[2] New York Medical Journal, 1915, cii, 435.
[3] Deutsch. med. Wchnschr., 1914, xl, 1686.    [4] Lyon, Chir., 1915, xii, 271.

56 cases of head injuries, including 28 scalp wounds, 23 bone lesions and 5 cases of simple concussion without apparent wound. Lumbar puncture was practised only in those cases with concussion due to the explosion of a shell in the vicinity and in wounds of the scalp, with or without a bone lesion. In regard to the pressure of the cerebrospinal fluid, Baumel has come to the conclusion that "simple concussions and wounds of the scalp, penetrating and non-penetrating, are always accompanied by marked increase in cerebrospinal pressure." Increased pressure is therefore pathognomonic of a head injury, and is more or less durable, according to the degree of the traumatism. It may continue for two weeks or over a much longer period. Xanthochromia is of considerable importance as a diagnostic sign, as it almost invariably indicates a penetrating wound of the skull; indeed, xanthochromia was found only three times in 28 cases of scalp wounds, and was demonstrated fifteen times in 23 cases with a lesion of the skull. It is of particular importance because it makes its appearance within twenty-four to thirty-six hours of the injury, gradually disappearing as the patient recovers. A sanguinous fluid is indicative of a subarachnoid hemorrhage. In cases in which the fluid, at first clear, later becomes tinged with blood, the concussion has caused a marked change in the cerebrospinal equilibrium and the rapid decompression resulting from the lumbar puncture brings about a hemorrhage *a vacuo*. A slight clouding and thickening of the fluid with a reddish reflection may be due to a fracture of the skull with a dural lesion and a subarachnoid effusion of blood, but the latter are not invariable signs. Chemical analyses show that albumin is increased only in penetrating wounds; out of 23 cases with bone lesion, the amount of albumin was normal in only 3 instances, and in these cases the injury was very slight. It varied from 0.3 to 0.8 gr. per 1000, and there seemed to be no constant relation between the hyperalbuminosis and hypertension, although the increase in albumin did not persist so long as the hypertension in most instances. Baumel believes that, in addition to the concussion, there is a slight subacute inflammation of the meninges; these result first in an increase in pressure and when they become more marked in a hyperalbuminosis, the latter being due in part to the inflammation of the meninges and in part to effusion of blood. When lymphocytosis is demonstrated by cytological examinations, it is always indicative of meningitis or a subacute irritation. Baumel found pure leukocytic reactions rare; in fact they never occurred in scalp wounds and only once in a simple concussion. Polynucleosis develops quickly in the acute stages and makes the prognosis very grave.

From his experience in these 56 cases, Baumel has come to the conclusion that lumbar puncture is of distinct therapeutic value in simple concussions and non-penetrating wounds of the scalp. He does not agree with Tuffier that it should replace trephining in penetrating wounds

of the skull, but he does believe that it may allay the symptoms due to increased pressure, such as headache, slowing of pulse, and transitory paralysis of certain cranial nerves. No injurious effects have followed its application, and in those cases in which it seems useful it should be practised systematically and repeated daily.

**Wounds of the Head.** Wounds of the head have quite naturally held a place of prime importance in the foreign literature on brain surgery during the past year. While it is still too soon to draw positive conclusions from the great mass of material which has thus far been written on the subject, nevertheless much may be learned from a review of the more important articles. It is most interesting to note that the purely conservative policy of v. Bergmann *et al.* is gradually giving way to more radical views regarding intervention for cranial trauma through the efforts of v. Eiselsberg, Hildebrand, Holbeck, Clairmont, Colmers and others. This change of opinion is to be attributed largely to the great advances which have recently been made in brain surgery in times of peace, to the greater accuracy of diagnosis made possible through the use of the röntgenogram, and to the better understanding which we have gained of the normal and pathological physiology of the brain. Each side still has many supporters, however; indeed, according to the more recent reports it would seem that the majority of surgeons in the present war are taking a middle ground and advocating early and active surgical intervention in certain carefully selected cases. Through the many improvements in technic and instrumentarium, the prognosis of head injuries in the hand of the surgeon skilled in this particular field is constantly becoming better. It is now possible to prevent meningitis in many cases which a few years ago would have been considered hopeless. Through intelligent and prompt action abscesses are opened and drained in many instances before a fatal encephalitis has developed, and by the removal of depressed fragments of bone and a careful repair of cranial defects before brain prolapse has become excessive, paralysis may be prevented and the development of later complications, such as epilepsy, may be forestalled. There is much diversity of opinion regarding the methods of treating cranial trauma; even that almost classic discussion as to whether gunshot wounds of the head should be left opened or closed has been unearthed and discussed anew.

The indications for intervention in wounds of the head depend primarily upon the type of the wound, that is, whether it be a tangential or penetrating wound, and, if the latter, whether the projectile has passed through the head, whether it has remained close to the surface or embedded deep in the brain substance. Marburg and Ranzi,[1] from their experience in 33 cases of head injuries in v. Eiselsberg's Klinik, have come to the following conclusions regarding the indications for

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[1] Wien. klin. Wchnschr., 1914, xxvii, 1471.

operative intervention: (1) Operation is indicated in all tangential wounds showing a depression of bone in the röntgenogram and exhibiting general or local symptoms; (2) operation is indicated in all penetrating wounds in which the projectile lies near the surface; (3) operation may be resorted to in cases in which the projectile lies deeply embedded if grave symptoms appear, but the chances of recovery are small; (4) operation is contra-indicated in cases in which a prolapse of the brain has already appeared. .

The stand taken by Engelhardt,[1] who is working with Spitzy, regarding intervention in cases of tangential wounds is very similar to that of Marburg and Ranzi. Engelhardt states that headache alone should lead to a very careful examination of the skull, but that a large osteoplastic operation should not be undertaken with the thought that an extra- or intradural hematoma is present, in the absence of local symptoms and röntgenological evidence of a bone depression. Indeed occasionally, as in one of Engelhardt's cases, paralysis may disappear without operation when there is a bone depression in the motor region, although operation is usually indicated in these cases. The indications given by Tabuteau[2] are as follows:

1. Although there may be no obvious depression to be seen, yet if the bone shows bruising or laceration of the periosteum, it is more than likely that some definite damage to the inner table will be found. In these cases a small trephine opening should be made and the inner table examined.

2. In cases in which such external signs are absent, but in which there has been loss of function, even if only temporary, persistent headache, giddiness, vomiting, or other signs of cerebral irritation, trephining should always be done. By so doing, serious sequelæ are avoided.

It must be constantly borne in mind that many cases which at first appear perfectly harmless, may later develop very grave symptoms because of an abscess or other lesion which has passed undetected. v. Haberer,[3] speaking from his experience in a reserve hospital, advises that in every case in which one cannot be certain whether a wound of the soft parts be accompanied by a bone injury, an exploratory incision be made under local anesthesia. Tabuteau[4] and Roberts[5] also advocate excising the wound and making absolutely certain of the condition of the underlying structures because of the great difficulty of estimating the actual damage to the bone by the appearance of the wound and because of the very injurious effects of probing. Leriche,[6] who has seen 397 cases of head injuries, routinely follows a similar plan, making an exploratory incision under local anesthesia in every wound of the scalp,

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[1] München. med. Wchnschr., 1915, lxii, 1096.
[2] British Medical Journal, 1915, ii, 501.
[3] Wien. klin. Wchnschr., 1914, xxvii, 1559.      [4] Loc. cit.
[5] British Medical Journal, 1915, ii, 498.      [6] Lyon Chir., 1915, xii, 293.

carefully examining the bone, and, if the latter appear at all abnormal, a trephining is done. If the dura be intact, this should never be incised, no matter how extensive may be the subjacent hematoma, contusion of the brain and immobility of the dura. In this way obscure cases which may later develop untoward symptoms will not be sent home where the necessary treatment may be impossible. Even this exploratory incision, however, should be done only by the surgeon skilled in cranial technic, and in a well-equipped hospital where further operation may be performed, if found necessary. In making the exploratory incision, the greatest care should be taken not to infect the underlying structures. In the reserve hospitals there should be every possible appliance for diagnosing serious brain and skull injuries. The value of the röntgenogram is inestimable. Even the röntgenogram cannot be depended on absolutely, according to Roberts,[1] as in several instances a depressed fracture has been found, which was not shown in the plate, and in 2 cases, where the plates apparently showed depressed fractures of the inner table, no such lesion was found. At the same time much valuable information is usually gained, especially as to the presence and situation of metallic foreign bodies.

In those cases in which active surgical intervention is indicated, the earlier it is undertaken, the better the prognosis. All are agreed, however, that operation should be postponed until the patient can be taken to a well-appointed hospital back from the firing line where he may remain at least two weeks after the operation. The prospects for recovery are slight if the patient has to undergo immediately after the operation a long transportation during which time the wound cannot be properly dressed.

When the clinical manifestations, the röntgenological findings, or the conditions revealed by the exploratory incision, indicate active surgical intervention, many questions arise as to the proper method of procedure. How much bone should be removed? Should the dura be opened if found intact? Should wounds be left opened or closed? Concerning all these points there is much diversity of opinion. Some make a large opening, others remove only enough bone to permit removal of spicules and other debris; some prefer to tampon or drain the wound, while others suture it firmly. The exploratory incision mentioned above should be performed as early as possible. If no bone lesion be revealed, the wound can be sutured. If, however, the bone be found injured and further operative intervention be indicated, great care should be taken to prevent the diffusion of infection. The edges of the wound should be freshened and a new set of instruments should be employed for further exploration.

Marburg and Ranzi[2] first expose the lesion in the bone, which is then enlarged by means of chisel and hammer and Luer forceps to facilitate

[1] British Medical Journal, 1915, ii, 198.                    [2] Loc. cit.

the removal of depressed fragments. In the majority of instances they have found that there is a slit-like opening in the dura through which the brain abscess may be reached. Bone is removed for a distance of about 1 cm. around the wound in the dura and the abscess drained. Contrary to Leriche's practise of never opening an intact dura, Tabuteau[1] states: "In several cases in which it had been found to be discolored, non-pulsating, and doughy, I have opened it by a crucial incision and a varying amount of disintegrated brain matter has been extruded, and was carefully wiped away. This brain matter is practically useless, and although some people consider that it may become absorbed in time, I think it is much better that it should be removed, otherwise it may act as a foreign body and give rise to after-symptoms. The risk of the brain becoming infected is considered by some to be sufficiently serious to bar the opening of non-lacerated dura, but if all due precautions are taken, infection should not occur, and certainly in those cases in which an opening was made there was no after-trouble." Guleke has come to the conclusion that the bone defect should be enlarged only sufficiently to cleanse and drain the wound cavity. When dealing with a depression with no hole, he makes a small opening with a chisel before inserting the forceps, thus avoiding concussion. With regard to the amount of bone to be removed, Tabuteau is of the opinion that "an area of bone should be removed around the injured part until it is quite certain that all the depressed fragments have been removed. In cases in which the dura has been opened it is necessary to remove bone until an area of healthy dura at least $\frac{1}{3}$ to $\frac{1}{2}$ inch broad has been exposed all around the laceration." Immediately after removal of the overlying bone fragments, brain pulp, splinters of bone and masses of the contused brain protrude themselves through the opening. For the removal of any spicules of bone and other debris which may remain behind, Guleke prefers the insertion of the gloved finger rather than an instrument. This should be done very quickly and carefully, and perferably only once. In this way, one ascertains the size and shape of the cavity and can thus estimate as to the proper drainage. Guleke advocates a drain made of rubber just long enough to reach the bottom of the cavity; he does not believe that the gauze tampons used by v. Eiselsberg, and others, are to be favored for purposes of drainage, as they quickly become saturated, stopping the flow, are difficult to remove, as they become adherent to the brain particles, and, once withdrawn, cannot be replaced without trauma to the brain. These difficulties are overcome in most instances by the use of a rubber drain. Guleke also cautions against premature removal of the drain, since the deeper parts of the wound have a tendency to separate with the retrogression of the edema until the lost brain substance is made up by scar tissue.

[1] Loc. cit.

Marburg and Ranzi[1] are very strongly opposed to immediate occlusion of wounds of the skull, as advocated by Barany[2] and his followers, and hold that tamponing with sterile gauze is quite sufficient and by far the wisest plan. If no abscess be present, it is their practise to diminish the size of the wound of the soft parts by means of a few sutures. Prolapse of the brain in cases of wounds is due to increased pressure brought about by edema or abscess, and hence is scarcely to be controlled by covering the wound with skin or other material. Moreover, in gunshot wounds, Ranzi[3] holds that infection is primary, not secondary, as Barany believes, and attributes the good results in Barany's cases (9 recoveries out of 12 cases) to the fact that most of the cases were operated upon within a few hours of injury in a well-equipped hospital. Since the infection is primary, Ranzi holds that it is best treated by the open method. Indeed in cases which came to autopsy, he found that meningitis was far less serious on the side where there was an opening, whether it was made by the bullet itself or by trephining. Barany's decision is based upon the very poor results which he had obtained by the open method—9 recoveries out of 39 cases—the cause of death being encephalitis and meningitis in all cases. By careful autopsy studies he has come to the conclusion that, while theoretically the bullet canal is infected, practically it is to be regarded as sterile, the infection being due to some secondary cause; therefore immediate occlusion of the wound should be the method of choice. In none of the cases primarily sutured was there any swelling of the wound or any secretion. Guleke,[4] who, in times of peace and in the beginning of the present war, was in favor of primary suture of head wounds, received early and not infected, now advocates the open method, inserting a rubber drain and loosely tamponing the outer wound. This change of policy as due to the frequent development of infection under the sutured skin and the consequent prolapse, necessitating the removal of the sutures. The increasing edema which is present in most cases makes any cutaneous plastic operation quite futile. Primary suture of gunshot wounds was proposed as long ago as 1892 by Langenbech at the German Surgical Congress, at which time the debate was closed by Thiersch with the memorable words: "I think we would do best to leave gunshot wounds open as in the past and close the discussion." It seems to me we can scarcely do better than agree with Thiersch until some more convincing evidence is forthcoming in favor of primary closure.

While it is still too early to judge as to the final results of the treatment of wounds of the head in the present war, nevertheless we have sufficient data at hand to enable us to see that advances have been made in this very grave field of war surgery. Marburg and Ranzi state that out of

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[1] Loc. cit.

[2] Wien. klin. Wchnschr., 1915, xxviii, 525.

[3] Ibid., 555.

[4] Loc. cit.

33 gunshot wounds treated in v. Eiselsberg's Klinik, 29 were operated upon. Out of 17 tangential wounds in which an operation was performed, there were 3 deaths; of 9 cases of penetrating wounds in which operation was performed there were 4 deaths, and out of 3 cases in which the bullet had passed through the head, 1 death. Guleke[1] gives the following results in 141 cases of cranial trauma: Of 12 penetrating wounds, in which the bullet had passed through the head, 2 deaths; of 26 cases of penetrating wounds, 3 deaths; of 103 tangential wounds with injury of the skull, 35 deaths. Lapointe[2] has operated upon 127 cases of wounds of the skull and has found that the wounds in which the dura has not been opened are remarkably harmless, while of those involving the brain, 58.75 per cent. have been fatal. He attributes the grave prognosis in most of these cases to infection due to the lack of first-aid measures, and suggests that the scalp around the wound be shaved as soon as possible after the injury.

Meningitis and encephalitis, needless to say, are the most frequent cause of death following cranial trauma, and even though a wound may have completely healed, a guarded prognosis must be given because of the possibility of the development of a late meningitis, encephalitis or brain abscess. Engelhart[3] mentions a case in which an abscess had been exposed and drained and in which a serous meningitis later developed because of the relation between the brain abscess and the right anterior horn of the lateral ventricle; at autopsy, there was no trace of abscess, but there was a widening of all the ventricles, a scar-like distortion and a high-grade granular ependymitis of the right anterior horn of the fourth ventricle. According to Marburg and Ranzi, Guleke *et al.*, the infection extends along the base of the brain rather than on the convexity, and is much more pronounced over the hemisphere which is intact than on the wounded side. Therefore the prognosis is usually much better for wounds of the base of the brain than for those involving the convexity. It must also be remembered that, as Guleke has pointed out, an encephalitis frequently develops in the vicinity of an old abscess, since the walls have only a low degree of resistance and are easily ruptured. In 22 cases of brain abscess, he has found, in 5 instances, a focus of softening in the neighborhood after opening the abscess. He has also found that abscesses develop much more frequently in the cases which are not operated upon than in the cases in which a primary operation is performed, and they usually appear within the first month after the injury. Out of 21 cases of abscess, 14 appeared during the first two months, 2 after the second, 3 after the third, 1 during the fourth, and 1 during the sixth month.

In addition to the late abscesses, there are certain other factors which tender the prognosis grave, particularly the possibility of the

[1] Loc. cit.        [2] Jour. de Chir., 1915, xiii, 211.        [3] Loc. cit.

development of epilepsy in consequence of a cyst formation, adhesions or depression of bone. This sometimes appears soon after the injury and sometimes not for years. Regarding the paralyses resulting from injury of the motor region, these often disappear completely, but sometimes seem quite unaffected by the operation. And the same is true of injuries of the occipital region, causing ocular disturbances; while the latter usually disappear, there may remain color-blindness or a narrowing of the fields. Nervous and psychic disturbances are also a frequent sequence of cranial traumata, and traumatic neurosis sometimes follows. Therefore the prognosis for wounds of the head, operated upon or not, is not bright. Nevertheless, much has been accomplished by active and prompt intervention in carefully selected cases.

## THE FACE AND NECK.

**Treatment of Parotid Fistula.** Attempts to correct these fistulæ by surgical means have lead to the development of several different methods. Leriche[1] has stated that the fistula can be obliterated by destroying the secretory nerve of the gland. He exposes the auriculotemporal nerve and slowly twists it out of the gland by Thiersch's method.

Crouse[2] has published a description of an elaborate operation which comprises a vertical incision in the cheek starting 2 cm. below the zygomatic process and 2 cm. in front of the ear. The incision should be about 3 cm. in length. It cuts through the skin and fatty tissue only. When the fascia of the parotid is reached, a 1 cm. incision is made in it. The lip is then everted and a strip of buccal mucous membrane pointed at the end and about ¼ inch wide is dissected up and the wound immediately closed with a continuous suture. The strip should commence slightly within the vermilion mucous borderline of the upper lip, and extend back slightly posterior to, or even with, the cusp of the second upper molar tooth. A curved Doyen or similar forceps is passed through the external cheek wound over the surface of the masseter muscle and, puncturing the buccinator, enters the mouth just in front of the base of the flap of mucous membrane previously dissected up. The forceps are widely stretched to dilate the new orifice and the strip of membrane grasped and pulled into the cheek wound and sutured to the incision in the parotid fascia, the ends of this suture being secured to a loop of No. 5 ten-day chromic gut, the ends of which remain in the mouth proper.

**Cancer of the Mouth.** Abbe[3] contributes a brief note emphasizing the important relation which the excessive use of tobacco has to cancer. He studied the histories of the last 100 cases of mouth cancer seen in

[1] Zentralbl. f. Chir., 1914, xli, 751.
[2] Surgery, Gynecology and Obstetrics, 1915, xx, 593.
[3] New York Medical Journal, 1915, cii, 1.

private practice. The tongue showed cancer or a precancerous condition in 36; inside of the cheek, 15; gum, 21; lip, 14; throat, 14. There were 10 women and 90 men. All were heavy smokers, except 1 who had a cancer of the lip in a scar from an old baseball injury. He found that six among 36 cancers of the tongue were in smokers of cigarettes only, one being a woman who smoked a package daily. One woman with an advanced cancer of the tongue had developed the habit of rubbing snuff on the side of the tongue with a tooth-brush. Of the 100 patients examined, 13 had chewed tobacco as well as smoked occasionally. These 13 all had cancers starting inside the cheek where the quid was held or on the edge of the palate or tongue nearby.

Buyo Cheek Cancer. This interesting disease common in the Philippine Islands, is discussed in two interesting papers by Davis.[1] The first paper discusses the etiology, and the second the technic of operation. "Buyo" is composed of buyo leaves, betel-nut, slaked lime, and tobacco. The leaves contain an essential oil; the nut contains tannic and gallic acid; and the lime introduced to give a pleasant, sweet taste to the chew is also, according to Davis, an important, if not the most important, factor in the production of the irritation. The lesion occurs more frequently in women than in men because they are more addicted to chewing buyo.

Davis reviewed the histories of all cases of mouth cancer recorded in the Philippine General Hospital and found that in 49, 65 per cent. were cancers of the cheek and in everyone of these in which the question was put, it was found that the patient chewed buyo. He states that it is as definite and as constant etiologically, clinically, and pathologically, as are the *x*-ray cancers, the kangri skin cancers, the paraffin-workers' epitheliomas, and the chimney-sweep cancers.

At first a small elevated growth in the mucosa of the cheek is noted. This becomes ulcerated and painful. The growth slowly progresses and takes on a cauliflower-like shape and projects into the oral cavity. Abscess formation is common, bleeding often occurs, and the teeth in the region of the growth fall out. In the later stages the cheek may be perforated, and the regional submaxillary lymph glands involved.

In the second paper, Davis described an operation for the disease in the early stage. An incision is made from the angle of the mouth below the border of the ramus of the jaw and thence back to the angle of the jaw. The cut is deepened to the bone and the cheek elevated and everted, exposing the malignant growth which is excised by a circular incision cut wide of the margin of the epithelioma. A second incision is cut in the neck and corresponds to the defect made in the inner aspect of the cheek, the pedicle or hinge being at the upper part

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[1] Journal of American Medical Association, 1915, lxiv, 711; Surgery, Gynecology and Obstetrics, 1915, xxi, 48.

and just below the angle of the jaw. This flap is turned into the mouth, bringing the skin surface toward the oral cavity and the cut surface
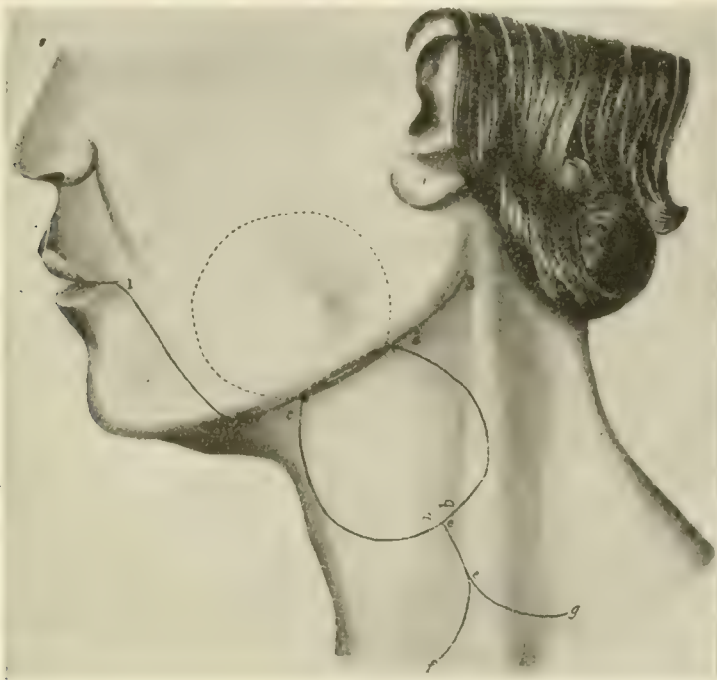


FIG. 1.—This drawing shows the first incision, *1-2-3*, made to give access to the growth, and the second incision *c-a-b-d*, the skin of which is undermined and turned back as a flap, using *c-d* as a pedicle or hinge to cover the defect in the cheek made by removal of the growth and is represented in its new position by the dotted lines and the third incisions *a-e-f* and *b-e-g* which are made to form flaps to cover the defect resulting from the turning up of the flap *c-a-b-d*.



FIG. 2.—This drawing shows the incision *1-2-3* sutured. The flap turned up from the neck into the mouth is represented by the dotted lines, and the pedicle or hinge by the line *c-d*. The flaps *a-e-f* and *b-e-g* are slid up to the line *1-2-3* to cover the defect caused by the turning up of the flap *c-a-b-d*.

of the flap next to the cut surface of the cheek made by removal of the epithelium. The edges of this skin flap are then sewed to the edges of the mucous membrane of the cheek. The regional submaxillary lymph glands are now removed. A third incision is next made to close the defect of skin in the side of the neck. This is an inverted Y-incision, the two flaps being undermined and slid upward to the original line below the ramus of the jaw.

**Fracture of the Inferior Maxilla.** Fracture of this bone is interesting not only because of its frequency but also because there is almost invariably associated a wound of the mouth compounding the fracture. A discussion in the Section on Stomatology at the Session of the American Medical Association in 1914 was productive of several important conclusions.

Dunning[1] reports his experience based on 1065 cases treated: 89 per cent. of these were single; 10 per cent. double. In 5 cases there was a triple fracture and in 1 a quadruple; 93.5 per cent. of the fractures were compound. In discussing the treatment, Dunning mentions the necessity for careful attention to the hygiene of the mouth and recommends that the teeth should be cleansed first of all of food particles. The gums and teeth should be cleaned every two hours by means of cotton swabs on a stick soaked in hydrogen dioxide and water (equal parts). Broken-down, decayed roots and loose teeth near the point of fracture should be extracted, because, if not removed, they may cause abscesses. Hot or cold compresses should be applied if there is much swelling and the jaws held together with a Barton bandage. Later, as the swelling subsides, a more permanent means of fixation may be employed. In fracture of the median line when there is not much deformity and when there are one or more sound teeth on either side of the fracture, a cap splint or single arch splint made of rubber or metal should be used. In fracture at the molar region, the cap splint could be used unless the teeth are not strong, when wiring of the entire lower jaw to the upper should be done, until there is partial union and then the cap splint may be put on. Fractures posterior to the third molar and in the ramus are best treated by interdental splint and wiring the jaw with Angle's wires. The open operation is unnecessary and generally results in necrosis and infection. Non-union rarely occurs and is generally due to faulty or delayed treatment. He mentions the dietary used for these cases, the patient getting as many raw eggs (four to six per day) and as much milk (from one to two quarts) as possible, and is fed every two hours. The diet ought to be carefully worked out for each patient and it should be remembered that when the jaws are wired together by the Angle method for a month, patients may loose from 15 to 20 pounds.

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[1] Journal of American Medical Association, 1915, lxii, 132.

**Parapharyngeal Abscess.**—One often sees in children, and especially in infants, a swelling, both oral and external, which may be a peritonsilar or retropharyngeal abscess, or a suppurating cervical adenitis. In other cases the abscess resembling the retropharyngeal variety may involve entirely the external tissue of the pharynx.

We have referred to this before,[1] and Heiman[2] presents a very compact and complete paper this year. He calls attention to the fact that the superior chain of the deep cervical glands drains the mouth, tonsil, palate, and pharynx, etc., and forms the lateral columns of the pharynx. Any inflammation of the rhinopharyngeal mucous membrane may be followed by a parapharyngeal, as well as a retropharyngeal, abscess.

The early symptoms of parapharyngeal abscess are those of a mild inflammation of the pharynx, occurring usually in the course of one of the infectious diseases. Then, suddenly, there is fever, septic in type, discomfort, difficulty in swallowing, and thickness in speech. The swelling occurs lateral to the tonsil and externally below the angle of the jaw. There is seldom edema of the uvula or pharynx. The tonsil is seen to be displaced toward the median line.

Heiman believes that such abscesses are best treated by an external operation with drainage as soon as the diagnosis is made. Internal incisions mostly fail to cure.

**Cleft Palate.** The various operations for cleft palate based upon the raising of mucoperiosteal flaps are founded upon the principles enunciated by Langenbeck in 1862. This may be called the operation of "median suture," and, in an excellent review of the subject, Blakeway[3] concludes that it is still the best for routine use. He compares it with the "turn-over-flap" operation of Arbuthnot Lane and with the operation devised by Brophy.

As is well known, Brophy assumes the deformity to be due to failure of union between the two halves of the palate, each of which, however, is fully developed. When failure of union has occurred, the two halves are separated by the upward pressure of the jaw and of the tongue, and the upper jaw is found wider than normal by the width of the cleft.

Accordingly, Brophy pushes the bones together in early infancy and holds them by silver wires. Blakeway states that by a series of careful measurements in normal infants the upper alveolar borders are wider apart than the lower, and the difference noticeable in cases of cleft palate is often not much greater than that seen in children born with fully united palates.

Blakeway therefore thinks that the operation of Brophy is based on unsound principles. He also examined 10 cases treated in St. Bartholomew's Hospital in 1911 and 1912 in which the effect upon the cleft was disappointing because in no case was closure of any part of the

[1] PROGRESSIVE MEDICINE, March, 1909, p. 53.
[2] American Journal Diseases of Children, 1915, x, 104.     [3] Lancet, 1915, i, 479.

cleft effected, except of the gap in the alveolar arch and possibly a small portion of the hard palate immediately behind this.

Kaerger,[1] however, is more enthusiastic. He operates on the jaw by Brophy's method at about the age of three weeks, closing the palate by median suture at the age of about three months, and operates on the hare-lip a fortnight later. Thirty-nine of 54 cases had the plastic operation upon the bones performed, with 3 deaths, and 3 other deaths following median suture of the palate, and 1 due to the operation on the hare-lip.

In the symposium on cleft palate at the meeting of the Clinical Congress of Surgeons of North America, in London, in 1914, Brown,[2] who has written a good deal on this subject, stated that compression of the upper maxillæ in early infancy endangers the developmental process upon which the future form of the nares, the palate, the upper dental arch, and the face depends. The wires inevitably destroy from one to four, or more, of the developing tooth germs and the failure of eruption of these also interferes with the shape of the arch or vault. In the same symposium, Brophy[3] discusses the results, and exhibited 3 patients to show their powers of phonation.

The Lane operation consists, briefly, in raising flaps from the oral surface of the palate and turning them over like the pages of a book, attaching them along the edge of the cleft. Over the hard palate the flap consists of all the soft tissues including the periosteum, and its edge is tucked under the opposite mucoperiosteum. In the region of the soft palate, the flap includes only mucous membrane and sub-mucous tissue, and is in part covered by a second flap turned across from the nasal surface of the opposite half of the velum.

We have previously discussed this operation, and especially the controversy on the subject between Mr. Lane and Mr. Berry. Berry[4] again states that no proof of the ultimate results of the "turn-over" operations has been brought forward to show that the result is really good.

Goyder,[5] while conceding the superior claims of the Langenbeck operation, believes that the Lane method is of advantage by reason of its simplicity and from the fact that it is applicable at any age. He closes the hare-lip early, and then, at about the age of twelve months, closes the cleft palate without using a flap large enough to uncover the unerupted teeth. He makes one interesting point in his article, namely, the necessity for accurate registration of cases of cleft palate in order that the merits of the different types of operation may be proved. He suggests the following form: (1) the type of cleft; (2) the age at operation; (3) the details of operation; (4) the result, as regards appearance,

[1] Arch. f. klin. Chir., 1914, Bd. ciii, 255.
[2] Surgery, Gynecology and Obstetrics, 1915, xx, 89.    [3] Ibid., 98.
[4] Ibid., 85.    [5] Ibid., 95.

scarring, mobility, and length of palate immediately and ultimately; (5) the result as regards speech after a sufficient interval has elapsed; (6) speech if any, previous to operation, and the mental capacity of the child; (7) speech education; whether it has been available or made use of; (8) the nutrition of the child at the time of the operation; (9) antenatal pathology. As to antenatal pathology, many points, such as the ages, nutrition, and position of the parents, a pedigree of the family, previous illnesses of the parents (especially syphilis), are of great interest.

In another article, Goyder[1] reported a series of 26 cases operated upon by Lane's method, of which 1 infant and 1 of the older cases died. Of 13 cases in infants up to fourteen months, there was complete closure in 9 after one or more operations; and of 13 cases in patients over fourteen months, there was complete closure in 11 after one or more operations. But, then, the time limit is not stated, and the 2 deaths were reported as "complete closures."

Blakeway reports upon 100 consecutive cases operated upon by the Lane method from April, 1905, to January, 1907, in the Great-Ormond Street Hospital. They have therefore been seen at intervals varying between approximately five and nine and a half years, and consequently conclusions may justly be drawn as to the affect of the operation upon the speech as well as upon the healing of the palate. There were 33 deaths, 19 of which are judged to have been due to the operation, and Blakeway estimates that the mortality of the operation is 16.2 per cent. Pneumonia, diarrhea, and vomiting are the chief causes of death. Reliable data concerning the results as regarding closure of the palate were obtained in 40 cases. In 15 cases of complete cleft of the hard and soft palates, there was complete closure in 7, after one or more operations; in 19 cases of cleft of the soft and part of the hard palate there was complete closure in 8, after one or more operations; and in 6 cases of cleft of the soft palate only there was closure in 3, after one operation.

As regards the condition of speech: In 40 patients who have been seen, and of whom none received skilled training after operation, speech was good in 6 cases, fair in 8, and poor or bad in 26.

Most of these writers, therefore, are in favor of the Langenbeck method of median suture. Blakeway quotes from the well-known statistics of Berry, published in his book on hare-lip, in which 154 cases were operated upon, with only 20 exceptions traced. Of the cases of complete cleft, 73 per cent. obtained complete union and none were utter failures. In complete cleft of the soft and partial cleft of the hard palate, there was complete success in 73 per cent.; in cases of cleft of the soft palate, only 87 per cent. were completely healed.

In this series, speech would be considered good in 55 cases; fair in 44 cases, and bad in 13 cases. In conclusions, Blakeway believes that

"in cases of cleft of the soft palate only, or in the soft palate and a small part of the hard, there is probably little to choose between the results in cases treated by the best hands; but that in cases of greater severity there is a much better prospect of success if Langenbeck's operation is used at a suitable age by a surgeon accustomed to its performance."

Eastman[1] has contributed several articles on this subject. He seems to prefer an early operation except in those infants which are so far below the normal as to make operation attended with great risk. He states that those surgeons who operate in the second or third year will have a lower mortality-rate than those who operate early, but that many of those who would otherwise perish before this time can be saved by early operation. He is opposed to the use of the lateral incision as done by Mr. Lane. If the flaps are freely and completely elevated from the hard palate, the soft palate split along the edge of the cleft, and the tensor palati aponeurosis divided, there is usually no trouble in bringing the lateral halves of the palate together without tension, and, when they are thus drawn together, they are red and vascular and in a favorable condition for union.

He draws attention to that form of cleft palate in which half of the alveolar process, with the attached premaxillary process, is situated ventrally to, and quite out of alignment with, the other half of the alveolar process. To draw the premaxillary process backward into alignment, one as a rule may place much confidence upon the repaired hare-lip in cases of combined hare-lip and cleft palate. The sustained pull or pressure of the tight lip gradually forces the protruding premaxillary process back into its normal position, in many instances without the aid of any surgical procedure. Occasionally, however, the premaxillary process can only be drawn into aligment through the aid of some surgical procedure or appliance. The use of a simple twisted wire loop is unsatisfactory, because such an unprotected wire loop often cuts the tissues, perhaps releasing itself and almost surely doing damage to the tooth bulbs. A better plan is to press the premaxilla back into alignment and hold it there by means of Brophy's leaden plate and silver wire device. If it is desirable to make the retaining device stronger, this may be done by using malleable-iron wire and aluminum plates with rubber washers. By using thick rubber pads or shoes under the aluminum plates, the gums are protected and a constant elastic pressure is exerted. Malleable-iron wire is much stronger than silver wire. The twisted ends of the wire is allowed to hang out of the corners of the mouth and cannot injure the tongue. The ends may be further protected by perforated shot.

Eastman also discusses certain factors of safety in cleft palate surgery. First, as regards the possibility of separation of the wound margin

[1] Surgery, Gynecology and Obstetrics, 1915, xx, 91; and Journal Indiana State Medical Association, 1915, viii, 550.

and consequent failure of union, in addition to the mattress coaptation suture and the reinforcement of the simple running suture, he advocates the use of a continuous relaxation suture passing around the free edge of the anterior palatine arch as a further support. He prefers a series of knotted loops. A suture of linen thread is passed through the edge of the anterior palatine arch from one side near the side of the tongue, drawn through to its middle and secured with a reef knot, leaving the tail of the suture long. The suture is then introduced every 3 or 4 mm. around the palatine arch to the opposite side crossing in front of the base of the uvula. Each time that it is drawn through the arch it is tied to the tail of the suture by a reef knot. The second factor of safety mentioned by Eastman concerns anesthesia. If young infants are operated upon, he uses local anesthesia, novocain 0.5 per cent. solution, to which is added adrenalin. In the newborn, ten to twenty drops of this solution on each side suffices to produce anesthesia and blanch the tissues. In the Langenbeck operation, the needle is slanted inward along the line of the lateral incision and injected by gentle pressure on this line toward the free edge of the cleft. The final point made by Eastman is that the blood swallowed by the infant produced serious disturbances to metabolism, manifested immediately by fever and easily avoided by washing out the stomach by means of a medium-sized catheter promptly after the palate operation.

A useful modification of the technic for hare-lip operation has been advanced by Ladd.[1] In order to obtain a good-looking lip with an inconspicuous scar, he calls attention to two essential rules: (1) the incision for freshening the edge of the fissure must be a clean cut made vertical to the plane of the lip; (2) the incision on each side of the fissure must be of exactly the same length. For the former he uses two pairs of clamps made something after the principles of the circumcision forceps; for the latter, he employs an ordinary small pair of sharp-pointed metal dividers.

**Sarcoma of the Tongue.** Two cases of this rare lesion were reported by Coughlin.[2] They have collected all of the cases from the literature, 60 in number including their own, and from these the following may be formulated: 10 cases occurred in patients under twenty years (19.6 per cent.); exactly the same number are found in the next decade; in the fourth decade, 14 cases (27.4 per cent.) were found; and there were 11 over forty years. In only 10 of the cases was any mention made of previous injury.

Sarcoma of the tongue seems to be more common on the right side toward the base, although no one part of the tongue can be said to be an especially favorite site of the growth. It begins most often in the tongue substance and grows toward the dorsum, soon causing a projec-

[1] Boston Medical and Surgical Journal, 1915, clxxii, 55.
[2] Journal of American Medical Association, 1915, lxiv, 291.

tion in the upper surface.   Just as in other situations, the growth soon
infiltrates, traverses the median septum, and invades the other side of
the tongue, finally spreading to the faucial pillars and to the floor of the
mouth.   In by far the greater number of cases the patient comes for
relief in less than ten months after the appearance of the growth.   The
growth varies greatly in size, commonly exhibits ulceration, and presents
nothing noteworthy in the absence of this, the mucous membrane
over the growth being generally smooth, sometimes fixed, and of normal
color.   Coughlin seems to have been unable to determine with exactitude
the chances of glandular involvement, but there seems to have been
13 with glandular involvement before operation and 2 in which the
glands were found to be involved after operation, a total of 15 cases
out of 37 with undoubted glandular metastasis, or 40.5 per cent.

Usually the first symptom noticed by the patient is the feeling as
though a foreign body were in or on the tongue, and, depending on
whether the growth is on the anterior or posterior part of the tongue,
the next is likely to be interference with speech or deglutition.   Pain or
soreness, often severe, is frequently observed and may occur in the
presence or absence of ulceration.   Dysphagia is a constant symptom
when the tumor is in the base of the tongue and is due not only to the
pain, but also to the mechanical interference with swallowing.   Dyspnea
is common as a later symptom.   Because of the rareness of the condition
and the absence of a dependable macroscopic picture, the diagnosis is
rendered unusually difficult if one forgets that there is such a thing as
sarcoma of the tongue.   It may be confounded with such inflammatory
lesions as chronic interstitial glossitis, tuberculosis, syphilis, actinomy-
cosis, or chronic abscess, or with other new growths.

Local removal only has been practised in 25 cases, and of these,
recurrence occurred in 10.   In 6 others, less than two years had elapsed
since operation, and only 3 of the 25 are *known* to be well more than
two years.

In 23 cases either partial or complete removal of the tongue had been
effected, and of these about 10 patients were well two years after opera-
tion.   Coughlin quotes from Fripp and Swan[1] who, in personal com-
munication with the surgeons who had reported cases, were able to follow
25 cases in which operation had been performed.   Eleven of the patients
had lived without a recurrence for from six months to thirteen years.
Of 14 cases with recurrence, in 9 it was local only, in 1 in the regional
glands only, and, in 4, both locally and in the glands.   Just as in cancer,
the two-year limit is entirely too low, because recurrence has been noted
up to three and a half years after operation.   The author refers to 1
case which recurred eight days after operation and several others
recurring in two weeks.

¹ Guy's Hospital Reports, 1902, p. 88.

**Excision of the Tongue.** Many years ago the operation of Langenbeck was practised with a remarkably low immediate mortality, but in time it was abandoned because of the unsightly scar produced, and because no adequate provision was made for extirpation of the involved lymph nodes.

In 1889 Krespi and Bastianelli modified the operation by dividing the lower lip in the median line instead of from the angle of the mouth downward, and prolonging the incision outward along the lower border of the mandible to the anterior border of the sternomastoid.

Recently, Ashhurst[1] offered an improvement in order to meet the second objection, namely, the removal of the lymph nodes. The following is the technic:

Endotracheal ether anesthesia is used preceded by morphine and atropine. The incision extends from the point of the chin downward in the midline to the hyoid bone, and thence along the side of the neck affected, following the folds of the skin, well below the body of the mandible to the mastoid. The incision passes only as deep as the platisma and is at once undermined downward. A block dissection of the neck is done from below upward, from below the bifurcation of the common carotid artery to the floor of the mouth. The hypoglossal spinal accessory, and spinal laryngeal nerves must be preserved, but all of the branches of the arteries and veins are included in the dissection. The dissection crosses the mylohyoid and around its posterior border in the floor of the mouth, removing the entire submaxillary salivary glands along with the rest of the cervical tissues. The lower portion of the parotid gland is also cut away to insure complete removal of the lymphatics. The cervical "block" is still attached to the upper skin flap and is now turned up and dissected off the platysma, being removed with the mass and the facial artery ligated. The wound is then swabbed with a 2 per cent. solution of iodine and covered with a hot, moist pack.

The second stage of the operation comprises the removal of the tongue. A mouth-gag is inserted and a suture passed through the tip of the tongue. The original incision is then continued upward from the point of the chin to the free border of the lip, dividing the lip and exposing the bone. The mucous membrane between the lip and the mandible is then divided until the ascending ramus is reached. The masseter is not cut. A suture is passed through the glosso-epiglottidean fold and both sutures in the tongue drawn taut. The pharynx is packed. The frenum is divided and the mucous membrane of the floor of the mouth divided back to the anterior pillars of the fauces on both sides. The latter are divided and the tongue drawn well out of the mouth. The tongue is then severed half-way across its base (at least 2 cm. beyond the visible limits of the carcinoma), on the diseased side, and then from the

tip of the tongue back along the floor of the mouth to the transverse section, also on the diseased side. The tongue is now held in the mouth solely by the hypoglossus and geniohyoglossus muscles on the side opposite to that diseased; as these are cut, the lingual artery and sometimes the dorsalis linguii spurt and must be cut and ligated. The molar teeth on the diseased side are then extracted, and the alveolus cleared of mucous membrane. If necessary, the alveolus may be excised. This permits the mucosa in the buccal surface of the cheek to be drawn
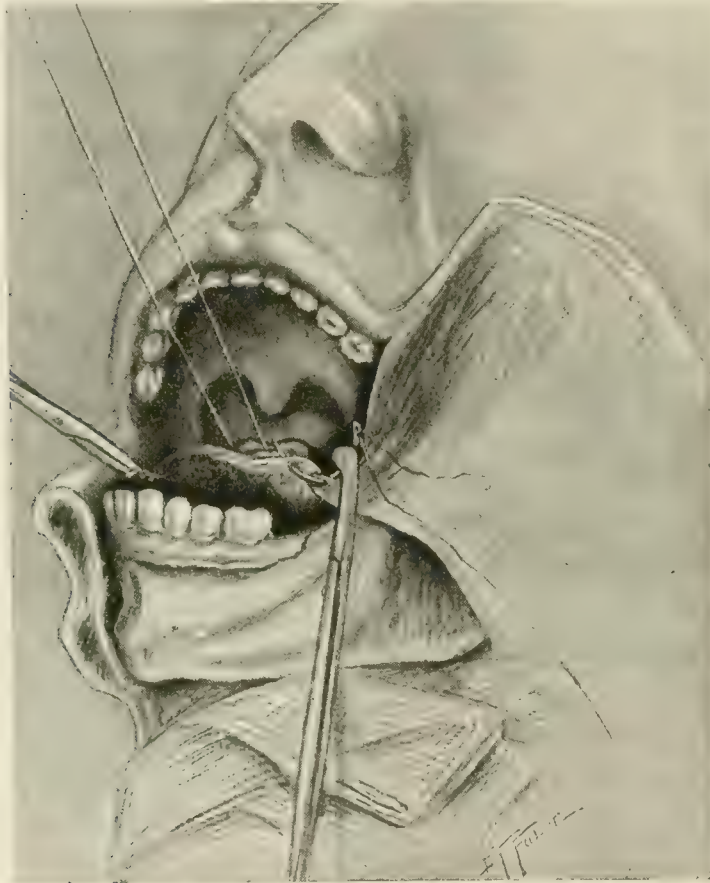


Fig. 3.—After removal of tongue, floor of mouth is covered partially by suturing mucosa of cheek across alveolus to stump of tongue. A hemostat is on right lingual artery in floor of mouth.

in as a flap and sutured across the denuded alveolus to the stump of the tongue. (See illustration of this important point.)

The remaining portion of the stump of the tongue is sutured as securely as is possible to the mucosa still remaining on the inner side of the alveolus throughout its extent, and the mucosa of the vestibule of the mouth is sutured to that of the lower lip from behind forward. The cheek is attached to the body of the jaw with buried sutures, and the skin wound accurately closed. Rubber-tube drainage is introduced from below the floor of the mouth to the most dependent portion of the incision. The suture in the glosso-epiglottidean fold is allowed to remain

in twenty-four hours or longer until the patient regains the power of swallowing.

When removal of all the cervical lymphatics is contemplated, Ashhurst



FIG. 4.—Skin incision sutured; drainage tube in place. Suture through glosso-epiglottidean fold retained for first twenty-four to thirty-six hours.



A                                             B

FIG. 5.—*A*, Bastianelli's incisions for extirpation of the cervical lymphatics; *B* Incisions suggested by writer.

believes it advisable to do the excision of the tongue at a second operation two or three weeks after the neck operation. He suggests the following skin incision for such an operation. (See illustration.)

"The incision (*a-b*) begins at the hyoid *near* the midline, and passes straight downward to the suprasternal notch; it is continued thence along the clavicle to the acromion (*b-c*). The triangular flap thus outlined, containing only the skin (not the platysma), is raised and the deep dissection is begun at the root of the neck, after section of the sternal and clavicular attachments of the sternomastoid. When more room becomes necessary, the incision is extended from *a* to *e*, and this large flap, *containing the skin only*, is reflected toward the trapezius as a base. When, in the further course of the dissection, the submaxillary and submental regions are reached, and still more room is required, the incision *a* to *d* is made, and the flap *d-a-e* is turned up over the mandible. In this manner free exposure of the entire side of the neck is secured from the clavicle to floor of the mouth, and all the diseased structures are removed in one mass, the sternomastoid being sectioned again close to the mastoid. After thorough cauterization (black heat) of the floor of the mouth from beneath the jaw, the flaps are replaced and accurately sutured, with tube drainage at *a* and *c*."

**Tuberculous Cervical Adenitis.** A symposium[1] on this subject appeared early last year. The first article by Richards, on the relation of the tonsils and adenoids and other throat conditions to tuberculous cervical adenitis, is along the usual lines and is illustrated by pictures taken from Most.

Chadwick discusses his experience at the Westfield State Sanatorium, and concludes that surgical interference is only necessary to remove such glands as have become caseous or fibroid.

Hawes repeats, to a large extent, the opinions expressed in his previous paper.[2] I would distinctly agree with his inference that radical surgery of this disease should be limited to those who have the necessary skill and training to perform the operation properly. He has found the following class of patients to do well with tuberculin:

(*a*) Those who have been operated upon more or less extensively for tuberculous glands. The tuberculin being a great help not only in curing the immediate trouble but in preventing recurrences.

(*b*) Those who have been discharging sinuses which have persisted in spite of proper treatment.

(*c*) Where the glands are more or less scattered or diffused throughout the neck, making operation inadvisable, and yet where the patient is living under proper hygiene.

(*d*) The comparatively rare cases in adults in which a large mass of glands, often smooth, hard and immovable, is surrounded by some periglandular tissue.

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[1] Richards, Chadwick, Porter, Hawes, and Wright, Boston Medical and Surgical Journal, 1915, clxxii, 1.

[2] Progressive Medicine, March, 1913, p. 93.

Wright discusses the relation of the dentist to tuberculosis, and shows the anatomical relation between the teeth and the glands. He believes that the individual or combined activities of the streptococcus, staphylococcus, pneumococcus, or other organisms in diseased teeth act as the agents which prepare the tissues and open a pathway for the subsequent invasion of tubercle bacilli.

Porter's paper was not published, but Stone gave a full description of the surgical viewpoint. He stated that cases of tuberculous lymphadenitis should be treated either as glands or as abscesses; no middle ground being tenable. If enlarged glands have persisted for a material length of time and are not subsiding within a couple of months, then these glands ought to be removed surgically. Abscesses should be opened and drained.

Broughton, in discussing the time for operating on the tonsils and adenoids, preferred to do the tonsillectomy when the glands are receding or before they are at or near the breaking-down point. When the glands are enlarged and are about ready to break down, by operating one throws an additional burden upon the gland, increasing the amount of septic absorption and hastening their breaking down. Meyer[1] discusses the conservative treatment of tuberculous glands of the neck in the usual way, and makes a point of the fact that only about 30 to 60 per cent. of the enlarged glands are tuberculous.

In our previous discussions on this subject we have emphasized the necessity for differentiating tuberculous from ordinary suppurating glands, and we still maintain that a group of cervical glands, diagnosed tuberculous, are best treated, in the majority of cases, by a clean excision, not a block dissection, with its subsequent rapid convalescence and almost uniformly good results.

Our cases have been followed and we know the results and see no reason to change from the previous opinion.

**Gummatous Cervical Adenitis.** Sometimes cases of cervical adenitis supposed to be tuberculous turn out to be syphilitic in origin, and, in all cases where the mass is not quite characteristic, the possibility of syphilis should be borne in mind, and a history and Wassermann reaction obtained to make the distinction.

Coues[2] reports 4 cases supposed to be tuberculous which turned out to be syphilitic. Operation had been done, only to be followed by sinuses and recurrence, and then, the true diagnosis being made, specific treatment cleared up the condition.

**Hodgkin's Disease.** This interesting disease has been studied a good deal by numerous observers. In the past, various names were applied to the same condition, lymphadenoma, malignant lymphoma, pseudo-

[1] Medical Record, 1915, lxxxviii, 65.
[2] Boston Medical and Surgical Journal, 1915, clxxiii, 777.

leukemia, etc. Since the work of Reed, Andrews, Longcope, and many others, we have had clearer conceptions.

Much discussion has arisen regarding the etiology of Hodgkin's disease, whether an infection or a neoplasm. As far back as 1894, several observers noted the occurrence of small cocci and bacilli in the glands. In 1907 Longcope produced transient glandular enlargements in monkeys in the Laboratory of the University of Pennsylvania. In 1913 Negri and Miermet[1] reported the finding of a diphtheroid bacillus in cultures made from the gland in Hodgkin's disease. A number of American investigators, notably Bunting and Yates, Billings and Rosenow, Ives, etc., have reported the isolation of the same organism in cases studied. Bunting claims to have produced in monkeys histological Hodgkin's disease by innoculating the B. hodgkini.

The work of Bunting and Yates has been familiar to us for several years and in a recent communication they[2] state that Hodgkin's disease is a non-communicable, infectious, granulomatous procecess due to the B. hodgkini and protein in its clinical manifestations.

In this paper and in another[3] published during the same year, they give a resumé of their opinions and researches regarding this disease. It is essential that one should understand the fundamental description of Reed.[4] In discussing the pathology, Yates and Bunting refer to four fairly distinct stages:

1. Early precharacteristic lesions. An exudate is followed by a deposition of fibrin and an accumulation of neutrophiles and plasma cells. A little later fibroblastic proliferation is noted, and the first development of characteristic changes in the appearance of the large endothelial cells and the tendency to minute necrosis with subsequent esosinophilic infiltration.

2. Early characteristic lesions. A moderate advanced diffuse fibrosis, the occurrence of many endothelioid cells, and the characteristic picture of the disease.

3. Late characteristic lesions. Extensive fibrosis, diminution of the lymphocytes and the other characteristic lesions.

4. Terminal characteristic lesions. Not always seen because death may occur before they can develop. Advanced fibrosis, with but few cells, mostly endothelioid, between the fibers.

They make some interesting observations regarding the gross pathology of the disease. They state that it is incorrect that the capsules of the lymph gland are never penetrated, and that the periglandular tissues are therefore not directly invaded. It is also incorrect that there is no matting together of the glands or formation of adhesions to the

[1] Centralbl. f. Bacteriol., 1913, lxvii, 292.

[2] Wisconsin Medical Journal, 1915, xiv, 94.

[3] Journal of American Medical Association, 1915, lxiv, 1953.

[4] Johns Hopkins Hospital Report, 1902, x, 133.

skin or deeper structures, a periadenitis being virtually constant. The fluctuations in size, consistency, and degree of mobility often noticed in the course of the disease are probably attributable to a large extent to waves in intensity in this periadenitis. Again, contrary to a frequently repeated statement, foci of macroscopic softening do occur without any secondary infection.

Yates and Bunting evidently entirely reject the neoplastic idea of Hodgkin's disease, and also that the B. hodgkini is a modified form of the B. tubercle. They discuss certain interesting observations regarding conditions allied to Hodgkin's disease. They recall that Banti believed that primary splenic anemia was quite possibly a splenic form of Hodgkin's disease, and they have obtained a pure culture for B. hodgkini in all of the 4 cases studied. They also obtained the organisms from 1 case of mycosis fungoides, and from 1 case of hypertrophic arthritis.

In the second group, the atypical glandular variety simulating lymphosarcoma, 3 cases have been studied and cultures obtained from 2.

In the third group, simulating lymphocytic leukemia, the organism may be obtained; and in a fourth group, associated with tuberculous adenitis, inconclusive results have as yet been obtained.

The certain diagnosis rests upon three factors: hematological, bacteriological, and histological, since other affections such as hyperplastic tuberculous adenitis may simulate the clinical picture too closely for any other differentiation. Of course, neither bacteriological nor histological examination can be made unless a gland is removed for study; but they warn against partial excision because this is accompanied by actual, and not hypothetic, dangers of dissemination. "Test excisions" are therefore absolutely contra-indicated unless the stage or character of the disease is such that the only hope lies in vaccine therapy, should its value ever be indisputably established. Hematologically, one sees two distinct types, an early and a late, showing a constant characteristic increase in the number of platelets (unless exhaustion of the bone-marrow occurs) with abnormally large forms and either a relative or absolute increase in the so-called transitional cells.

In the early type, the leukocytes are usually less than ten thousand; there is moderate increase in the basophiles, and, when the disease is well established, the eosinophiles are slightly increased, the polynuclears remaining within the usual limits, and the lymphocytes at, or slightly above, the normal.

The late type show a leukocytosis which may reach one hundred thousand, the neutrophiles are relatively increased and the lymphocytes are reduced to 5 per cent. or less. The transitionals are usually above 8 per cent. and always exceed the lymphocytes in number.

Yates and Bunting offer the following working hypothesis for the

attempt to cure the disease: (1) An exclusion of all possible liability to reinfection, hence a removal of the primary source of infection and its portal of entry; (2) the most rapid elimination of at least the major portion of the diseased tissue, with the bacteria and toxins contained therein, in order to prevent further dissemination and to place the balance of power in favor of individual resistance, wherefore its surgical extirpation when conditions permitted; (3) a destruction of the remaining bacteria by any and every means, especially the Röntgen rays, hygiene, and, more recently, vaccine therapy; (4) the conversion into fibrous tissue by hygiene and the Röntgen rays of such irremovable abnormal tissue as cannot undergo resolution; (5) and, finally, to continue treatment as circumstances seem to indicate until a clinical and röntgenological examination and a normal blood picture indicate a cure has been of at least a year's duration.

In the operative technic, they advise a complete radical block dissection, the entire area treated thoroughly and actively with tincture of iodine and drained. The Röntgen rays should be started not later than the second day, preferably with a few hours after operation, and continued at an interval of three days to the limit of skin tolerance. They also believe that axillary dissection should be as extensive and as thorough as the cervical one, and they also suggest that when the excision of the primarily effected cervical glands is not followed promptly by the progressive resolution of secondarily enlarged glands which may infect those in the mediastinum, then these glands also should be excised.

Thorough analysis of this scheme of treatment must await the course of time, because, as Yates and Bunting well say in their paper, a cure can be considered as established only when there is no trace of the disease at least five years after the last manifestation of the infection. They advise vaccine therapy on general principles, but are not particularly hopeful of its influence.

Another and somewhat contradictory paper is by Cunningham[1] who reports 23 cases from the Roosevelt Hospital, New York City, observed during the past five years. The primary foci have been, as far as observation permits: cervical, 13; axillary, 3; retroperitoneal, 3 right femoral, 1; intestinal, 1; and undetermined, 2. Three were of the acute type, 18 were of the chronic type, and 2 were of the latent type. Cunningham gives a resumé of the symptoms and physical signs seen in his cases in a most complete manner, but I do not think that anything especially new is presented. Bacteriologically, however, Cunningham isolated a diphtheroid organism related to, if not identical with, the so-called B. hodgkini from 3 cases of tuberculous lymphadenitis, 1 case of large round-cell sarcoma, 1 case of Hodgkin's disease, and 1 case of a peculiar glandular metaplasia.

[1] The American Journal of the Medical Sciences, 1915, cl, 868.

He is inclined to believe that this organism is not the specific organism of Hodgkin's disease. Further, Cunningham states that the Reed type is not a special form of Hodgkin's disease but is the picture which makes Hodgkin's a distinct entity. He makes the sensible suggestion that various glands in an enlarged group give different pictures and that when one performs an operation in view of obtaining a gland for diagnosis, several glands should be excised because, at either extreme, a positive diagnosis is difficult. He considers four stages:

1. Hyperplasia of lymphoid elements similar to that of any infection or irritation.

2. Hyperplasia of endothelial elements with giant-cell formation.

3. Beginning fibrosis and loss of the original architecture of the gland.

4. Fibrosis, atrophy of lymphoid elements, masking of characteristic.

The latter picture has been designated by Simmers[1] as "healing-in Hodgkin's." It is a picture similar to the end-results of an acute lymphadenitis, of syphilis, or even of tuberculosis.

Cunningham reports nothing new regarding the blood count; the number of transitionals was variable, though in general increased. It will be remembered that a high transitional count is considered by Bunting to be diagnostic when accompanied by chronic lymphatic enlargement. Cunningham states that he has recently had a case of primary sarcoma of the mediastinum with a transitional differential of 13.3 per cent.

Several of his cases were treated with a vaccine made from the B. hodgkini, but the results were not considered as favorable and he believes that since this organism is not the specific cause, it is futile and a waste of time and material to continue.

Ives[2] also states that surgical treatment is one of the most important aids in the proper management of cases of this disease. A radical operation, just as for cancer, is indicated. After operative intervention the Röntgen rays should be used in the hope of curing affected lymph glands that may remain and to prevent recurrence.

**Traumatic Asphyxia.** This comparatively rare condition occasionally appears in the literature and a typical example, with a beautiful plate, is reported by Linington,[3] in a girl, eleven years of age, who had been knocked down by a motor bus and imprisoned under the fender. The face and neck were livid, and the color terminated abruptly at the line of the clavicle. The conjunctivae were cherry-red and the ears were pallid. A detailed examination of the skin showed the discoloration to be due to innumerable punctiform spots, so closely set as to appear continuous, and not to any macroscopic extravasation of blood. The

[1] New York Medical Journal, 1911, xciii.
[2] Journal Missouri State Medical Association, 1915, xii, 439.
[3] Lancet, 1915, ii, 911.

respiration was rapid and shallow and there was a certain amount of air-hunger, but delirium, coma, and convulsions were absent. There was no nasal, retinal, renal, or pulmonary hemorrhage. In fourteen days all discoloration had disappeared.

Linington explains the *pathology* of these cases as being purely mechanical paralysis of the veins, venules, and capillaries due to over-distension. A continuous and steady pressure exerted for a short time on the abdomen and lower thorax forces the blood from the large veins in the liver into the right atrium which becomes distended, and the passage of blood into the superior vena cava engorges and dilates the tributory veins. The valves of the external jugular and, to some extent, of the internal jugular and vertebral, being but rudimentary, are easily forced and the veins become overstretched and mechanically paralyzed. The sluggish blood stream presents the rapid interchange of $CO_2$ and $O_2$ which causes the extreme discoloration, only disappearing when the vein has returned to its normal caliber and the current of blood to its normal rate of flow.

**Exophthalmic Goitre.** We have referred to the work of Rogers, in New York, at various times in years past. This year, in another paper,[1] he goes over nearly the same ground. I will quote his conclusions verbatum without comment.

"The indications for, and the forms of, treatment: Rest and good hygiene are essential for the cure of any thyroid disease; the antithyroid serum is the most efficacious of all conservative methods for many cases in the early stages of hyperthyroidism and for some of those in the exophthalmic group. In dosages of $\frac{1}{2}$ to 1 c.c. it is harmless, but if its exhibition intensifies the symptoms it should be discontinued. When conservative methods fail after a month's trial, the ligation of one or more thyroid vessels should be practised, or, less frequently and only in selected cases, the excision of half of the gland. Local anesthesia is preferable to general narcosis. Ligation of one or more of the chief thyroid vessels will cure a large proportion of all types of hyper-thyroidism. It is safer, but much slower in its effects that hemothy-roidectomy. For exophthalmic goitre, or the most advanced and serious form of hyperthyroidism, ligation of all four thyroid vessels seems to offer better hopes of cure than the more radical operation. Demi-thyroidectomy seems indicated especially in the third or hyperthyroid stage of the disease rather than in the fourth or that of exophthalmic goitre, and in patients over twenty-five years of age, who possess asymmetrical goitres of considerable, and not small, size.

About 25 per cent. of all cases of hyperthyroidism are only improved by hemithyroidectomy, and some 10 per cent. of them are not benefited at all or made worse, and the general operative mortality is at least 5 per cent.

[1] New York State Journal of Medicine, 1915, xv, 4.

Surgery at the best is but a rough approach to the means which a better knowledge of physiology and of organ therapy should provide for the relief of these patients."

BOILING WATER INJECTIONS. The method of treating hyperthyroidism advanced by Porter,[1] in 1911, has been received more favorably by surgeons than would be supposed. In his latest contribution, Porter[2] reviews the experimental work and brings the clinical experience up to date. He states that his assistants, Beall and Mouser[3] by experiments demonstrated (1) the safety of the procedure; (2) that the immediate effect of the injection of the boiling water was a destruction of the gland cells and colloid which is later replaced by connective tissue; and (3) that a goitre, in the dog, can, by this means, be cured permanently.

Injections were also made into the freshly removed human goitres and destruction of the cells and colloid was found. Porter states that clinical experience now covers over 100 cases, some of which were from his own practice, and the majority from the practice of other surgeons. The technic is as follows:

"An all-glass syringe of 10 or 20 c.c. capacity is best. The greater the capacity of the syringe, the longer the heat of the water is retained. The needle should be long, flexible, and rather fine. The syringe is boiled with water over a gas or alcohol flame by the side of the table or bed on which the patient is lying. After proper cleansing, the areas to be injected are infiltrated with 1 per cent. novocaine. The filled syringe is removed from the water, which is actually boiling, and the injection quickly made. From 5 to 20 c.c. are injected, according to the size of the lobe. By partially withdrawing the needle and reinserting it, contiguous areas may be injected through one puncture." Porter commends the method of handling the syringe as used by Babcock, and wears three pairs of gloves, first a pair of rubber gloves, covered with thick cotton gloves, and over these another pair of rubber gloves.

Most patients complain immediately after the injection of a feeling of fulness in the goitre and some pain in the sides of the occiput, but the discomfort is trifling. The injections are to be repeated until the desired effect is attained. If preparatory to thyroidectomy, the injections are made every two or three days, but in attempting a cure by this means injections should be made only once every ten days. It is better to make large multiple injections at one seance, rather than small single injections at repeated seances.

Porter concludes as follows:

"1. Injections of boiling water into the gland should be substituted for the so-called medical treatment in patients with small thyroids and moderate symptoms of hyperthyroidism.

[1] Journal of American Medical Association, 1911, lvii, 1120.
[2] Surgery, Gynecology and Obstetrics, 1915, xx, 1.
[3] Journal of American Medical Association, 1913, lxi, 93.

"2. This method is also peculiarly well adapted to the treatment of patients with moderate or severe symptoms and relatively small glands and especially to cases wherein the hyperplasia is circumscribed. It is therefore well adapted to the treatment of patients who have had a lobectomy done and are still suffering from symptoms of hyperthyroidism with hypertrophy of the remaining lobe.

"3. Patients with large goitres and extreme symptoms of hyperthyroidism should be treated with the injections until they become safe surgical risks and then have the gland removed.

"4. Boiling water injections are not recommended in non-toxic goitres. In such cases, as in patients with large goitres and toxic symptoms, but who are good surgical risks, thyroidectomy should be the chosen method of treatment.

"5. In substernal hyperactive goitres the removal of which would be hazardous, boiling water injections under guidance of the eye should be tried."

In my own practice the injection of boiling water is reserved for the desperate cases and those declining operative treatment. In the discussion of my paper before the Pennsylvania State Medical Society meeting last fall, Waterworth, who has had a large experience with goitre, stated that the boiling water injection is nearly as effective as ligation. He has used it about fifty times in 23 cases.

Porter quotes Babcock as stating that injection produces a more intense effect than a double ligation.

O'Day,[1] who also advocates Porter's method, reports 2 cases of hyperthyroidism with glycosuria or rather diabetes mellitus. Coincident with the boiling water destruction of the thyroid the diabetic condition disappeared. O'Day intends to enlarge upon these cases in a future paper on the carbohydrate tolerance in exophthalmic goitre.

THYROIDECTOMY UNDER LOCAL ANESTHESIA. Outside of a few clinics, this method is rarely used, except in certain Continental countries. A well-illustrated article by Hertzler[2] describes the technic. He believes that the secret of success in thyroidectomy under local anesthesia is that the surgeon must not hurt the patient. He gives a preliminary hypodermic of morphine, using a 1 per cent. solution of novocaine for the blocking of the nerves and a 0.5 per cent. solution for the deeper infiltration.

In very large goitres, quinine and urea hydrochloride is used for the skin and fascia. One must not be too timid in infiltrating the deeper tissues of the neck. Hertzler spoils his paper by an exaggeration of the simplification of the operative technic.

Lahey[3] also reports upon the use of local anesthesia in thyroidectomy.

[1] New York State Medical Journal, 1915, ci, 681.
[2] Journal Missouri State Medical Association, 1915, xii, 45.
[3] Boston Medical and Surgical Journal, 1914, clxxi, 598.

He uses a fresh solution of 2 per cent. novocaine with 15 mm. of adrenalin to the ounce. He infiltrates the skin, across the neck in line with the proposed collar incision. The incision is then made down to the platysma muscle. If the veins passing through the muscle are to be clamped, the novocaine solution is injected around them. An injection is then made between the platysma and the two underlying muscles and the flap turned upward. An injection is made along the anterior border of the sternomastoid muscles which are then dissected free from their attachments to the sternohyoid. Without further infiltration, the longitudinal incision is made in the median line to the surface of the gland. The muscles are separated from the thyroid and an injection made across them at the point of placing the double set of clamps for division. Practically no further injection is necessary. The author has operated on 8 cases by this method with success, although the operation cannot be said to be entirely painless.

Mainbridge[1] advocates local anesthesia in thyroidectomy because of the lessening of hemorrhage, the absolute protection of the inferior laryngeal nerve, the lessening of the strain on the kidney, the avoidance of postoperative vomiting, and the less elaborate technic needed.

RECTAL ANESTHESIA IN THYROIDECTOMY. Lathrop[2] has become an advocate of the Gwathmey method. He has operated upon 118 cases of goitre under this method of anesthesia and is convinced that it is ideal. Fifteen of these were of the exophthalmic type and there was 1 death, the only case in the series in which ligation was performed instead of a thyroidectomy. At the present time I am not convinced of the efficacy of this method and we have been so successful with our modification of the method of Crile as to feel that the complication of another method had best be avoided.

GOITRE AND LIFE EXPECTANCY. C. H. Mayo and Plummer[3] give a resumé if the work previously published, and tabulate the cases of simple and exophthalmic goitres seen at the clinic during the year 1914. Of the simple goitres, including the thyrotoxic (non-hyperplastic) goitres, there were 934 operations performed on 916 patients with 5 deaths, all of which occurred in patients with thyrotoxic degenerations. Of the exophthalmic goitres, there were 386 patients given operative treatment. Of these, there were 22 injections with hot water, with 2 deaths; 19 double ligations without mortality; and 388 single ligations, with 2 deaths.

They believe that the mortality of simple goitres without complications is largely due to surgical accidents and need scarcely be considered. The immediate mortality in exophthalmic goitre is about 3 per cent. and an additional 2 per cent. due to degenerations incident to the disease, or of lowered vitality, due to some intercurrent trouble within

[1] Medical Press and Circular, 1915, xcix, 265.
[2] New York Medical Journal, 1915, cii, 996.        [3] Lancet-Clinic, 1915, cxiii, 649.

six months following operation. The mortality in degenerating simple goitre, the so-called thyrotoxic goitres, is placed by them at at least 2 per cent. greater than exophthalmic goitres. In both types, a relapse will occur in about 10 per cent. of the cases.

**Tetany.** In reporting a case of tetany following parathyroidectomy, Johnston and Budd[1] give a very good summary of the present knowledge of the parathyroids and append a bibliography. In their patient an operation had been done eight years previously for goitre, with a stormy postoperative course. Some years later the goitre recurred, and, at operation, the thyroid was removed except for a piece on each side of the neck about the size of a bantam egg. Thirty hours after operation she became restless and showed twitchings of her facial muscles and of the muscles of the extremities. The twitchings became tremors and these convulsions, which became more and more severe until death occurred, fifty-two hours after operation. Calcium lactate and morphine were given.

## THE MAMMARY GLAND.

**Chronic Cystic Mastitis.** Under the title of "Senile Parenchymatous Hypertrophy of the Breast," Power[2] reports that he has removed 17 breasts affected with this disease from 14 women. In 1 instance both breasts were involved and removed at the time of the primary operation, while in 2 other cases a woman who had suffered excision of one breast returned for removal of the other. In another patient from whom he had removed the right breast, it was ascertained the other was excised for the same condition by another surgeon. There was no mortality and there has been no recurrence of malignancy in any of these patients. Powers advises a thorough removal of the affected breast through a curved incision at the outer lower margin. In a considerable number of cases, he leaves the nipple. If one or more large segregating cysts be found they may be removed, but, whenever the disease is typical, with multiple cysts, nothing short of an entire breast excision will suffice.

Rodman[3] has also discussed this subject. He states that in a recent and careful analysis of 65 cases in his own practice he found that 14 (21.5 per cent.) had undoubtedly become malignant at the time of operation; in other words, "the process on all of the 65 cases began as a benign one, but in some had changed into a carcinomatous one at the time of operation." I wonder how Dr. Rodman knows this. He believes that except in exceptional cases the cure should be a complete removal of the breast, even as one should do in cancer.

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[1] Southern Medical Journal, 1915, viii, 135.
[2] American Journal of Surgery, 1915, xxix, 446.
[3] Murphy Clinics, 1915, iv, 248.

**Cysts of the Breasts.** In a paper read before the American Surgical Association, Bunts[1] reports the cases of cysts of the breast occurring in the practices of Drs. Crile, Lower and himself. Among 648 operations on the breast for every kind of disease, there were recorded 68 cases of cysts, representing all types without further classification. In 5 cases amputation of both breasts were performed; in 15, amputation of one breast; and in 48, only a partial amputation or excision simply of the cyst was performed. Of the 20 cases of total amputation, the average age was forty-one years, while in the remaining cases in which only excision of the cyst was done, the average age was only thirty-nine years.

The very important observation is made by Bunts that in 55 of the 68 patients, replies were received relating to the subsequent history, and in not one of these was there a history of a subsequent development of cancer, although as has been said in 48 of them only a partial amputation or excision of the cyst was done. In considering the advisability or necessity of operation, Bunts does not agree with the opinion that over the age of thirty years amputation is the conservative procedure. He believes that the final decision as to whether or not a complete operation should be performed should be determined by the clinical and physical aspects of the tumor and of the breast in which it is found. With this, we are in complete accord. In none of the cases reported last year did any cancer appear in those cases diagnosed as simple chronic cystic mastitis. It should also be noted that in only 5 per cent. of the cases reported by Greenough and Simmons did carcinoma occur in the breast tissue left by the partial operation.

**Sarcoma of the Breast.** This is a comparatively uncommon disease, and the monograph by Geist and Wilensky[2] is a welcome addition to the literature. The paper is a report from the Mt. Sinai Hospital in New York and in it they state that among 558 cases of breast tumor received in ten years, there were 122, or 3.9 per cent. of sarcomata of various types; of the malignant tumors, 7.7 per cent. were sarcomata. According to their histological types, the sarcomata were fibromyxosarcoma, 5; spindle-cell sarcoma, 5; round-cell sarcoma, 4; cystosarcoma phylloides, 4; giant-cell sarcoma, 2; perithelioma, 2. The small number of the phylloides is accounted for by the classification of some of these as fibro-adenoma with interstitial edema. The tumors occurred in women between the ages of twenty-nine and forty-nine, the average being thirty-nine years. All were married and the majority had borne children. In 2 there was a history of trauma, and in 3, a history of a previous inflammatory condition. The tumors all grew rapidly and most of them had a period of latency followed by rapid growth. In one-third of the cases the skin was fixed to the tumor; it was thin, red-

[1] Annals of Surgery, 1915, lxii, 246.     [2] Ibid., 11.

dened and tense. The skin in the neighborhood of the tumor usually showed dilated and reddened veins. Pain existed as a prominent symptom in one-third of the cases, and in two-thirds of these the growth involved the skin. In almost every instance large, soft nodes were palpable in the axilla, but in only 1 instance was a metastatic tumor present in the lymph nodes.

Of the 18 cases operated on, they were able to trace 11, and all of the patients but 1 are alive, the time since operation ranging from four months to nine years. Among them were 5 fibrosarcomata, upon 2 of which radical Halstead operations had been performed. The other 3 were excised locally. The time since operation ranged from one to six years. There were 2 cystosarcomata, in 1 of which a Halstead operation had been performed six years ago; in the other, an amputation of the breast, with removal of the axillary glands and fat, four months ago. One case of round-cell sarcoma died of shock following a Halstead operation; a second case, after bilateral local excision, returned in six months with a recurrence. Two cases of perithelioma, for which radical Halstead operation was done two and nine years ago respectively, are alive and well now. In 4 other cases a local excision was practised. In 2 the tumor promptly recurred; in 1 instance, two weeks, in another, one month after operation.

They have collected from the literature 435 cases of sarcoma of the breast, of which 31 per cent. were of the spindle-cell type; 14 per cent. of the round-cell type; and 12 per cent. cystosarcoma phylloides. Trauma was noted in about 10 per cent. of the cases. The consensus of opinion seemed to be that radical operation is advisable and that with this the prognosis is, on the whole, better than in carcinoma, even though metastasis and recurrence are fairly frequent. An extensive bibliography is appended.

**Paget's Disease of the Nipple and Allied Conditions.** Since Paget, in 1874, contributed the original observation on this disease, a continuous stream of contribution has appeared down to the present down. The most recent paper is by Jopson and Speese[1] who report 6 cases, 1 of which was from my clinic, and have abstracted and analyzed the work of other investigators. In the surgical laboratory of the Hospital of the University of Pennsylvania, among 450 cases of breast tumors we have had 2 Paget's. Perhaps it would be just as well to state their conclusions:

"1. Paget's disease of the nipple is a primary affection beginning in the cells of the rete Malpighii, potentially malignant, although lacking the ordinary characteristics of malignant disease.

"2. It is identical with the disease known under the name of Paget occurring in other regions.

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[1] Annals of Surgery, 1915, lxii, 212.

"3. It is commonly, although not invariably, followed by glandular carcinoma in the underlying breast tissue.

"4. It is precancerous in the sense that it induces epithelial changes in the superficial milk ducts and acini, which are followed by carcinoma. Occasionally, although rarely, it is followed by squamous-cell carcinoma of the nipple.

"5. The disease is characterized by edema and vacuolization of the prickle cells, thickening of the rete, and active mitosis, also by an inflammatory reaction in the corium and a secondary hyperplasia in the milk ducts.

"6. It is sharply differentiated from true eczema and scirrhous carcinoma ulcerating at the nipple, and should not be confused with superficial metastases of diffuse cancer situated near the skin.

"7. The resulting tumosr of the breast, and the regional metastases, resemble the type of breast cancer usually encountered. When the tumor originates in the skin, it infiltrates and metastasizes in the form of squamous carcinoma.

"8. The common association of cancer of the breast with Paget's disease demands as the treatment for Paget's disease the radical operation which is practised in breast cancers in general."

Rodman[1] states that Paget's disease is not primarily a disease of the skin, advancing inward. The cutaneous involvement is secondary, and is caused by the discharge which comes from the diseased tissue within. It is a duct cancer and is very fatal.

**Cancer of the Breast.** There have been but few articles written upon this subject in the past year. Three of these have been written by W. L. Rodman.[2] All of these are practically identical.

The most interesting part of Rodman's contribution is the tabulation of his after-results. Of 50 private patients taken consecutively (excluding 3 cases of acute carcinomatous mastitis, all of which were quickly fatal and which he now believes inoperable), 36 (72 per cent.) are well three or more years after operation. Thirteen are dead and 1 has a recurrence in the mediastinum. The case living with the recurrence was operated on about three years previously and had been considered inoperable by another prominent surgeon. Of the 50, there were 6 with such extensive axillary involvement that he was compelled deliberately to resect the axillary vein to get rid of all apparent disease and make a thorough axillary dissection. In 10 of them the subclavian triangle was explored, and, although he has never cured a patient with supraclavicular involvement, he does not consider it necessarily as an inoperable condition. In no case operated on since 1906, at which time he commenced to use the method now employed, is there any

[1] Murphy Clinics, 1915, iv, 257.
[2] Journal of American Medical Association, 1915, lxiv, 707; Murphy Clinics, 1915, iv, 247; Southern Medical Journal, 1915, viii, 565.

impairment in the function or edema. In the cases operated on since 1909, and of average severity, the x-rays have usually been employed, and in several advanced cases he is inclined to give at least part of the credit to Röntgen-ray treatment subsequent to operation. Rodman's operation is probably known, and consists of a straight incision, beginning one inch below the clavicle and two fingerbreadths to the inside of the arm or internal to the sulcus where the pectoral muscle joins the deltoid. The pectoralis major is exposed, hooked up on the finger, and cut at its insertion. The lower edge of the tendon of the pectoralis minor is exposed, hooked up on the finger and cut, being careful to avoid the long thoracic artery below the tendon and the acromiothoracic artery above. The costocoracoid membrane is next opened and largely sacrificed, giving access to the apex of the axilla. The dissection is begun at the apex, and, coming from above downward, at first is done by wiping with gauze. In the lower two-thirds of the axilla the fascia to the outside of the axillary vessels is incised, and the dissection continued with gauze or dissectors. The acromial, long and alar thoracic branches and the subscapular branch of the axillary artery, with their accompanying veins, are divided. The dissection of the axilla must be so thorough that nothing is left in its inner aspect but the posterior thoracic nerve, in the posterior aspect except the long subscapular nerve, and above, possibly, the superior thoracic artery. When the axillary dissection has been finished, a second incision is made from the middle of the original one, goes well above the breast to the middle of the sternum and then passes downward to a point midway between the ensiform and the umbilicus. A third incision passes beneath the breast and joins the lower extremity of the first. The epigastric triangle is then dissected, as suggested by Handley, and the sheaths covering the lower portion of the serratus and upper portion of the external oblique and latissimus dorsi muscles. In planning this dissection, the skin must be undercut considerably so that at least two inches of superficial fascia beyond the peripheral limits of the breast will be removed. Rodman states that by this method he has not been compelled to resort to skin-grafting in all simple cases since 1908. The breast itself is then removed and the wound sutured, after all hemorrhage has been stanched and all clots removed. He does not use drainage, and confines the arm for only twenty-four hours. He states that edema is a result of interference with the lymph stream, and is not due to venous obstruction; and, while a slight and transient edema is occasionally seen, it generally passes away, and in no case has there been experienced a disabling swelling of the arm.

The above statistics from Rodman, with practically 75 per cent. of cures, become more impressive when we read the reports of nearly every other author. Jackson[1] stated that, in operated and unoperated

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[1] American Journal of Surgery, 1915, xxix, 241.

cases, at least 75 per cent. of all women with cancers of the breast die of the disease, and that at least 50 out of 100 deaths could be avoided if only the cases were operated upon early enough. He believes that we should all persistently teach that every case of tumor in the female breast should be submitted to operation the moment of its first detection. It is, of course, true that many doctors temporize with lumps in the breast; but, on the other hand, it is also true that many women never seek advice for months after the appearance of a lump, unless pain occurs. It would say that in nearly one-third of the cases the patient is as much at fault as the attending physician.

Another article on cancer of the breast has appeared by Frank[1] who states that during the past seven years he has operated on 48 private patients for carcinoma of the breast and 18 are still living after three years. His percentage cannot be calculated because he states that there are also a number of living who have been operated upon less than three years ago.

Handley,[2] in a discussion before the Clinical Congress of Surgeons in 1914, discussed the *peripheral spread of cancer of the breast*. This is well understood by those who have read his book. He believes that the immense proliferative pressure of the epithelium at the primary focus forces cancer cells into the small lymphatics, along which they grow in continuous lines. This process is called permeation. Reaching the lymphatic plexus into which the breast in the first instance drains, the permeation involves a larger and larger circular area in this plexus, filling up its channels with lines of cancer cells and sending off shoots into the adjoining muscular and cutaneous layers. Sooner or later cancer cells are brought into the serous cavity and rapid visceral dissemination occurs. The main operative principles deduced from the permeation theory are: (1) the area which demands widest removal is that in which the growing edge is situated, namely, the deep fascia, in which is found the lymphatic plexus which forms the highway for the spread of the disease; (2) the area of deep fascia removed must be roughly circular in outline, since permeation spreads with approximate equality in all directions from the primary growth; (3) the primary growth must always be the centre of the area of fascia removed. Failure to observe this rule accounts for many recurrences; (4) the skin and muscles being secondarily involved over a smaller area, and less widely than the fascia, the removal of a smaller area of these tissues will suffice. The removal of the embollically invaded regional lymphatic glands is, of course, essential.

BREAST AMPUTATION BY A TRANSVERSE INCISION. A new method is advanced by Stewart[3] which has been tried on 40 cases by himself

[1] American Journal of Surgery, 1915, xxix, 244.
[2] Surgery, Gynecology and Obstetrics, 1915, xx, 72.
[3] Annals of Surgery, lxii, 250.

and 47 others by J. H. Gibbon. It is as follows: An incision skirting the upper margin of the breast is made from a point on the edge of the sternum farthest from the growth, and on a level with the nipple, to a point on the same level at the posterior axillary fold. The skin is undermined from the incision to the clavicle and the head of the humerus, and from the sternum to the posterior axillary fold. The pectoralis major and minor and the costocoracoid membrane are then divided in the usual manner. With a self-retaining retractor of the Balfour type, and a small retractor held by an assistant, the entire axilla is exposed and dissected out from above downward and from within outward. A second incision skirting the inferior margin of the breast is made, and the skin undermined to the level of the lowest portion of the costal arch, or even lower. The rectus fascia may be removed, although Stewart has not adopted this procedure as a routine measure. The breast is then removed, the wound irrigated, and closed with combined retention and coaptation sutures and a continuous suture of celluloid thread, except at the axillary end where one suture is left untied to provide an exit for a gauze drain which is removed in twenty-four hours.

Abdominal Skin-flap Method. Elsberg[1] describes an ingenious method of covering over the defect remaining after a radical amputation of the breast with extensive skin removal. Basing his method on the fact that the skin in the abdominal wall is generally very lax and receives abundant blood supply from the arteries which run from behind forward, he prolongs the lower end of the usual incision from the epigastrium downward to the right of the umbilicus and well below it nearly to the pubes. A second incision extends from the latter point, upward and outward, to just above the crest of the ileum. This large abdominal flap is dissected off the muscles, is slid up over the chest, and the defect in the abdominal wall easily sutured after undermining the skin. Pictures are given illustrating the method.

X-ray and Radium in Cancer of the Breast. One of the most complete papers which I have seen upon Röntgen therapy in the post-operative treatment of carcinomas of the breast has been published by Pfahler.[2] He believes that as there is a tendency to recurrence and metastasis in at least 20 to 25 per cent. of the cases, even with the early operation, and in at least 75 per cent. of those in which there has been glandular involvement, it is our duty to use every means at our command that gives promise of an increase in the number of cures. He believes that the treatment should be given as soon after operation as the patient can be safely removed to the Röntgen treatment room. When this is not possible for any reason, treatment should be applied at the earliest sign of recurrence, because he has shown in previous

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[1] Annals of Surgery, 1915, lxii, 678.
[2] Interstate Medical Journal, 1915, xxii, 1018.

papers that a considerable number of those cases with recurrence and metastasis can get well. In inoperable cases the patient should be at once referred for Röntgen treatment because he has shown that, even in these advanced cases, some can get well and all can be made more comfortable. Pfahler is enthusiastic upon the use of Röntgen treatment in the early cases when there is no glandular involvement.

Dachtler[1] is also enthusiastic about treatment in the early cases. Of 16 showing no axillary or glandular involvement at operation, 13, or 81 per cent., are alive and well after five years. Excluding again the doubtful cases that died before the five-year period has elapsed, but who were found at autopsy to be free from cancerous disease, the percentage of cures reaches 100 per cent.

Pfahler is very insistent upon the use of a proper technic. Thorough massive dose treatment by cross-firing methods may be expected to accomplish more than has been previously accomplished by the older methods. I feel that there is everything to be said in favor of the position taken by Dachtler when he states that as a result of his visits to leading hospitals eight years ago, he found that whenever unfavorable opinions were given, almost invariably, on investigation, faulty methods in technic were discovered. I have found that with the exception of the teaching hospitals and perhaps a few other places, the x-ray facilities in the vast majority of our hospitals are sadly inefficient.

Pfahler describes minutely the technic. He also suggests that an attempt be made to produce an atrophy of the sexual gland by Röntgen treatment in women who are still menstruating. In discussing the constitutional effects of treatment, he speaks of nausea and occasional vomiting and prostration occurring during treatment; he believes these are due to the gases which have generated, and that the air of the x-ray room should be kept as fresh and pure as possible by means of the suction apparatus. In some cases a hypersensitive nervous system probably also enters as a cause.

Fisher[2] presents an interesting paper on the same subject, and concludes that carcinoma of the breast should be treated first and foremost by early and wide removal of the diseased organ and all secondarily involved tissue, followed by thorough, continuous, and persistent x-ray exposures, over the site of the operation and all contiguous areas. He reports an experience in 92 cases in which x-ray exposures followed operation; 70 of these have been traced, with the following results:

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|---|---|
| Dead | 16 |
| Living with recurrence | 14 |
| Dead of other causes then cancer | 2 |
| Living and apparently well | 38 |

[1] Interstate Medical Journal, 1915, xxii, 268.
[2] Medical Record, 1915, lxxxviii, 17.

It will thus be seen that approximately 40 per cent. of the total number are living and apparently well after the lapse of three years from the time of operation. Fisher believes that the *x*-ray treatment should be begun early, probably within one week after operation and should be thorough. The cross-fire method from four or five different angles and a fairly hard tube with filtration of the rays is used. He treated them up to the erythema dose for the first year; gradually diminished the frequency of treatment in the second year to one every four to six weeks; and in the third year gave a prophylactic raying of the breast and all contiguous structures once every two months. The occurrence of recurrence is a cause of alarm, and both operation and the *x*-ray are usually futile.

A few cases are reported by Snow.[1] He discusses the superiority of treatment with aluminum fillers to the broad cross-fire method.

*Radium.* The report of the Radium Institute[2] of London, for 1914, shows that 67 cases of cancer of the breast were treated; of those who were apparently cured, 40 were recovered; 17 not improved; 1 abandoned treatment and 8 died.

Rodman[3] believes that we have heard entirely too much of radium and its marvellous cure and have had too little verification of its beneficial powers. He believes that whatever it will do, the Röntgen rays will do better. I might conclude this subject by quoting from Rodman, the following: "But, grateful as I am for the assistance of the Röntgen rays or any other agent in combating so protean an affection as cancer, I wish to state most positively that they have no place in the treatment of cancer of the breast until after operation. They will cure epitheliomas of the skin and superficial sarcomas which may be inoperable. This I have witnessed more than once. But I have yet to see a single patient with mammary carcinoma passing the three-year limit in whose case the credit could fairly be given to Röntgen rays. They are in my judgment and experience much better than radium, as the only 2 patients I have submitted to the latter treatment were unquestionably made worse by it and quickly succumbed. This was their opinion and it is mine."

[1] New York Medical Journal, 1915, cii, 43.    [2] Brit. Med. Jour., 1915, i, 367.
[3] Journal of American Medical Association, 1915, lxiv, 707.

# SURGERY OF THE THORAX, EXCLUDING DISEASES OF THE BREAST.

## By GEORGE P. MÜLLER, M.D.

**Chest Wounds in War.** Many reports are scattered throughout the literature upon this subject, but as yet there has not been sufficient collective investigation done to warrant passing final judgment upon what has been learned.

For instance, in the German literature, Volkmann[1] reported his observations at the Second Base Hospital at Stuttgart. He remarks that in the early days of the war when the army was moving, the whole chest was exposed to injury, but that later, when they were in the trenches, only the upper part of the thorax and the shoulders were exposed. Among 55 cases, 58.2 per cent. were due to infantry wounds, 18.2 per cent. were caused by shrapnel and the remainder by artillery fire. In 90 per cent. of the cases, hemoptysis was the chief symptom, and rarely lasted longer than five days. Shoulder pain was often encountered probably from involvement of the phrenic nerve. His classification is as follows:

1. Simple lung injuries, without complications, no effusion or signs of inflammation being present.

2. Complicating injuries of the lung (1) with hemorrhagic, sanguinolent, serous or purulent effusion; (2) with pneumothorax and emphysema; (3) with infiltration of the lung tissue.

His mortality was 6.3 per cent., and many of the cases had late results, such as high position and decreased mobility of the diaphragm.

Three articles are contributed by Toenniessen, Böttner, Ritter, Reiche, and v. d. Velden,[2] embracing in all over 200 cases of gunshot injuries of the lungs. Böttner reported that the abdominal wall was rigid in 34 of his cases, although the bullet passed through the chest alone. All of these writers advise conservative treatment except when infection of the chest occurs, when immediate operation is indicated.

In the French literature, Piery[3] reported over 100 cases of bullet wound of the lung in which there was hemoptysis only in a little more than one-half of the cases. He also advises conservative treatment, and leaves the hemothorax entirely alone. Extraction of the projectile

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[1] Deutsch. Ztschr. f. Chir., 1915, cxxxiii, 425.

[2] Münch. med. Wchnschr., 1915, lxii, 89, 91, 95.

[3] Presse Médicale, 1915, xxiii, 197.

from the wall of the thorax should be left until later. He states that with a simple wound of the lung there is merely a pneumonic process accompanied by a hemothorax, and the Röntgen picture simulates that of a small pleural effusion with congestion of the lung.

I saw a case of Dr. Frazier's, in the University Hospital last fall, who had shot himself twice through the upper part of the left chest. He had a moderate pneumothorax. The bullet wounds themselves which had perforated gave no trouble, but the patient developed the physical signs of a pneumonia in the upper half of the lobe and the x-ray showed some shadow for some distance around the bullet tract. There was a very moderate hemothorax. He eventually recovered after passing through a stormy convalescence from kidney trouble.

Desgouttes and Bressot[1] state that there is no constant relation between the amount of hemoptysis and hemothorax, nor is there any physical sign that enables one to make an absolute diagnosis of the injury to the lung not to determine its severity. Neither hemoptysis nor hemothorax can be considered as indicating injury to the lung, as they may be caused by contusion to the lung or injury to the thoracic wall.

LeFort[2] calls attention to the latter point, and reports 9 cases of pulmonary hemorrhage, 1 of them fatal, caused by superficial wounds of the thorax without any direct injury to the lung or pleura.

Greenough,[3] in reporting the work of the Harvard unit at the American Ambulance, states that they had treated 21 injuries of the chest. In 2 cases only the ribs and soft parts of the chest wall were injured, and the pleural cavity was not involved. In 9 the missile passed through the chest cavity, with wounds of entrance and exit, and in 10 the missile lodged. Eleven of the 19 pleural cases developed empyema, and 10 recovered. One case that died had spinal paralysis, death being due to bed-sores and exhaustion. One case died of hemorrhage into the pleura from a lacerated lung. Five of the 11 empyema cases were operated upon by rib resection; others had sufficient drainage provided by the original wound, or had healed to a small sinus, when they entered the hospital, and did not require further drainage. In 2 cases the posterior mediastinum was involved.

From the British side an interesting study of hemothorax has been reported by Bradford and Elliott.[4] After dilating upon certain experiences in the past, they state that the present campaign in Flanders has changed the previous teaching. The high-velocity bullets at short range or the tearing fragments of shell cause greater laceration than was previously seen, and the effusion of blood into the thorax is often

[1] Lyon Chir., 1915, xii, 266.
[2] Bull. et Mém. Soc. de Chir. de Par., 1915, xii, 1569.
[3] Boston Medical and Surgical Journal, 1915, clxxiii, 738.
[4] British Journal of Surgery, 1915, iii, 247.

so large in amount that it cannot very well be left alone. Further, the possibility of infection is so great that sepsis undoubtedly is a much more serious matter in the prognosis of chest wounds than formerly. They first consider the causes of death and then give a discussion of two groups, the sterile hemothorax, and the septic hemothorax.

As to the causes of death, they first studied a group of results derived entirely from postmortem examinations made on 84 bodies with chest wounds. Sixty-nine had an effusion of blood into the pleural cavity; and, of these, 23 died of complications, such as purulent bronchitis, paraplegia, or additional injury to the abdominal viscera. The remaining 46 died simply from the hemothorax which was found infected in 38 of the number and the death in every single one of these had been caused by the infection. They conclude that death from simple hemorrhage is not to be feared if the patient has survived to the third day.

The second group of statistics comprise those cases which were seen during life. They state that their figures are a little misleading, because, as the work increased in volume, they ceased keeping records of the mildest cases in which the effusion of blood was small or non-existant.

In Group A, observed from November, 1914, to the week of Neuve Chapelle in March, there was a total of 168 cases of hemothorax, sterile in 120, and septic in 48.

In Group B, observed from March to July, 1915, only the severe cases were, as a rule, recorded. There were 160 cases of hemothorax, 91 sterile and 69 septic. These give a total of 328 cases of hemothorax, 211 sterile and 117 septic. Death occurred in 47 cases, of which 36 were septic, and in only 2 cases was simple hemorrhage the cause of death. They believe that if they had noted the milder cases in the later series, a total of about 450 cases would have been seen, with a mortality of 10 per cent., 70 per cent. of which was due to sepsis.

The lesson to be drawn from this study of the causes of death is that infection is so important in every case of hemothorax that the wounded man should be removed as soon as possible, after the danger of hemorrhage has passed away, to a station where the infection can be promptly recognized and properly dealt with.

**Sterile Hemothorax.** The effusion, the clinical features, the differential diagnosis, the complications, and the treatment are considered here as well as in the subsequent group. They believe that as the presence of a sterile hemothorax may disable the patient by prolonged fever, by dyspnœa, or by a progressive collapse of the chest wall on the affected side, the free fluid should be removed by aspiration in all cases of effusion which exceed 20 or 30 ounces, that is, roughly, those in which dulness reaches half-way up the scapula.

In 89 sterile effusions aspirated, there was in no case any evidence of later hemorrhage or any gross reaccumulation of fluid, and in only one instance to their knowledge did an empyema develop afterward.

There is no way of telling when clotting of the blood has taken place, and, to avoid trouble from the clot, they introduce the needle well forward into the axilla at the anterior limit of the effusion and high up on account of the elevated position of the diaphragm. Fluid should be withdrawn slowly, and oxygen should be introduced when discomfort is noticed by the patient.

**Septic Hemothorax.** They state that every hemothorax with fever must be suspected of sepsis. The pneumococcus, Micrococcus tetragenus, and B. influenzæ were found in about 20 per cent., the remainder of the infections being caused by the streptococcus and staphylococcus and an anërobic gas-producing bacillus. One-half of the shell wounds and rather more than one-fourth of the bullet wounds caused a septic hemothorax. They present figures to show that early transport did not increase the tendency to infection.

Exploratory puncture for bacteriological examination of the fluid is the only sure proof that infection has occurred, but suspicion should be aroused in every case in which the general condition has not definitely improved by the fourth day after the wound.

The infected fluid may be removed by aspiration, which, however, leaves infected clot behind and continued suppuration. An ordinary wide resection close to the diaphragm yielded fairly good results, and in the recovered patients the more extensive operations for chronic empyema had not been required. Slit drainage has the advantage of aiding expansion of the lungs, but makes drainage of the septic clot difficult, so that they think it an unwise method. Rough handling of the inner pleural surfaces may break down inflammatory barriers and light up a fatal septicemia. A purulent bronchitis is a dangerous complication. A pneumothorax requires aspiration and anërobic infection often makes an excellent recovery.

In an excellent little book by Murphy,[1] treating of wounds of the thorax in war, the various well-known methods in vogue are described in a concise manner, together with a full description of the pathology and symptomatology. The book contains 150 pages and is too long for abstract.

An interesting preliminary report of some experimental observations on *the condition of the lungs during recovery from chest wounds*, has been made by Brodie and Mackenzie.[2] They made measurements of the residual air and dead spaces, employing both Haldean's $CO_2$ method and the hydrogen method, and also of the volume of the circulation through the lung, using Krough's nitrous oxide method for the purpose. The patients studied were recovering from pneumothorax, hemothorax, or empyema, and they all showed a very considerable limitation of move-

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[1] Wounds of the Thorax in War, Oxford War Primers, 1915.
[2] Lancet, 1915, ii, 912.

ment upon the injured side. In all cases the total blood flow through the lungs was higher, and often considerably higher, than that obtained upon normal individuals of the same weight. The compensatory increase of blood flow was therefore proportionally greater than the diminution of respiratory surfaces, owing to the damage to the lung. The measurements of the residual air enabled them to determine the rate of recovery as the patients gradually regained the use of the damaged portion of the lung. In offering suggestions for treatment of these patients, they found that simple, deep and forceful inspirations were sufficient. The patients were instructed on frequent occasions during the day to take some ten or twelve of the deepest possible inspirations, using a considerable amount of force in so doing.

**Surgical Treatment of Phthisis.** Two years ago this subject was discussed, and since then a number of articles have appeared bearing upon the subject. In general, it may be stated that operations which have for their object the production of collapse of the lung for phthisis are indicated when a nitrogen pneumothorax is impossible owing to the presence of adhesions between the visceral and parietal layers of the pleura. The names of Wilms, Sauerbruch, and Friedrich are especially associated with this work.

Recently Davies,[1] of London, has published an interesting article bearing on this subject and modifying to some extent the operation of Wilms. He operates as follows:

The patient is kept in bed for about a week before the first stage is done. He prefers chloroform to ether and administers morphine and atropine immediately before the anesthetic. The patient lies tilted on the sound side. A vertical incision is made along the outer border of the erector spinæ. The incision extends upward into the neck and at least one inch above the first rib and downward to at least one inch below the lowest rib to be resected. An injection of absolute alcohol is then made into each intercostal space in the direction of the nerves. The periosteum is then stripped from the ribs for a distance of 6 cm. and the exposed segment of bone removed. It is advisable to begin with the fifth or fourth rib, then to work upward to and include the first, and after that downward to and include the eighth or ninth, cutting through each rib as it is exposed. Great care must be taken in the separation of the periosteum and the cutting of the first rib to avoid injury to the eighth cervical and first dorsal nerve, the lowest trunk of the brachial plexus, and the subclavian artery. The divided muscles are stitched with catgut and the wound closed without drainage.

The patient should be kept in bed, should under no circumstances be given tuberculin, should be carefully fed but not overfed, and should have the proper amount of sleep. In about two weeks, or even longer,

[1] British Journal of Surgery, 1915, ii, 544.

the patient may be ready for the second stage. Much depends upon the condition of the patient as to the length of interval, but it is wiser to wait too long than too short a time. The second stage is done as follows: The patient lies flat on the back with the arm to the side. A vertical incision is made three-fourths of an inch from the lateral sternal line, extending from over the clavicle above to one or one and a half inches below the costal margin. All the cartilages from the second downward to and including the costal margin are freed from their perichondrium. As each cartilage is isolated, a piece of gauze is packed between it and the underlying pleura to prevent the constant to-and-fro flapping movements of this membrane with each respiration. The second costal cartilage is then resected, after which the first is freed from its attachments to the clavicle and, remembering the close relation of the subclavian vein, the innominate vein, and internal mammary artery and vein, the cartilage after isolation is divided. After this step has been accomplished, all the remaining cartilages are excised with sufficient of the costal margin so that the cut edges are still separated by about one-third inch at the moment of maximum approximation of the ribs to the sternum. As the support afforded by each of the cartilages is removed, the corresponding portion of the chest wall sinks in. It is necessary at this time to lighten the anesthesia so that the coughing reflexes are not abolished, because during the collapse pus-containing cavities may be rapidly emptied and the bronchi flooded with these secretions. The muscles are then stitched together with catgut and the wound closed without drainage.

There is but little deformity produced by this operation, and there is almost invariably a substantial amelioration of the condition. Time alone will tell whether the operation has a curative influence.

Sauerbruch,[1] whose work has been mentioned previously, discusses the use of what is known as *extrapleural filling*. It will be remembered, that in cases in which artificial pneumothorax cannot be attempted and in which it is not deemed advisable to do an extensive radical rib resection, it has been proposed to detach the parietal pleura from the chest wall and fill in the space with some non-absorbing material. Sauerbruch recommends paraffin, with a melting-point of 50° C., in this article.

Zinn and Mühsan[2] have also reported on the use of extrapleural thoracoplasty in 5 cases of tuberculosis and on 6 of bronchiectasis. In 4 of the cases the operation was successful. They also discuss Sauerbruch's rib resection.

In discussing these methods it should be remembered, however, that Sauerbruch's thoracoplasty differs from Wilms's in one important particular. The former removes segments of all the ribs through a hooked

[1] Beit. z. klin. Chir., 1914, xc, 247.    [2] Berl. klin. Wchnschr., 1915, lii, 45, 71.

incision which is really the posterior part of Schede's incision. It therefore requires a more extensive operation and is harder on the patient.

Other articles on the use of "filling" have appeared, such as those by Oeri[1] and by Frangenheim.[2] The latter author describes the various methods in use, with criticisms. Thus, paraffin is said to be heavy and liable to slide down below the cavity, it may work its way outward through the breech in the ribs and entail a suppurating fistula; the use of an inflatable bag to compress the lung is liable to lead to infection; fatty tissue (Wilms) theoretically is the best of all, but it may be rapidly absorbed.

The technic is simple. After resection of a portion of a rib, the lung is detached from all connection with the chest wall, the pleura being separated with the lung. The cavity wall is then pushed in to close it up completely, and the space between the costal pleura and the chest wall is filled with the "filling" and the incision sutured.

**Phrenic Nerve Resection.** Phrenocotomy has been advocated as a harmless procedure to assist in a collapse of the lung. It acts by paralyzing the diaphragm which then rises from intra-abdominal pressure, thus compressing the lung. Carl[3] reports various interesting animal experimentation, and concludes that phrenocotomy may be considered a relatively harmless procedure which may be performed under local anesthesia. A complete immobilization of the lung is, of course, not obtained, owing to the presence of other nerves in the rigid thorax. He suggests picking up the nerve at the scalenus muscle, crushing it with the hemostat, thus permitting a later regeneration. In the discussion of this paper, Sauerbruch states that resection of the phrenic nerve was only useful in combination with other methods, chiefly extensive thoracoplasty. In this discussion, Sauerbruch stated that he had now operated on 177 cases of tuberculosis of the lungs, in 122 of which he had performed a unilateral extrapleural thoracoplasty with 3 deaths from the operation, and 27 others who were unfavorably influenced and died later. In 65 cases there was marked improvement, and in 24 cases there was recovery, *i. e.*, the sputum disappeared and the patients could resume their work.

**Interpleural Pneumolysis.** A new method is proposed by Torek[4] in cases in which artificial pneumothorax cannot be done owing to extensive adhesions. Endotracheal insufflation anesthesia is used, and a long incision made in the sixth or seventh intercostal space. After careful hemostasis, the pleural cavity is opened; the head is lowered to allow cavities to empty through the trachea into the mouth. With the tip

[1] Correspondenzblatt f. Schweizer, Aerzte, 1915, xlv.
[2] Med. Klinik, 1914, x,, 1299.     [3] Beitr. z. klin. Chir., 1914, xciii, 348.
[4] Deutsche Ztschr. f. Chir., 1914, cxxxi, 132.

of the finger the adhesions are freed while the ribs are held apart. The adhesions between the two layers of the pleura are then gradually separated until the most distant parts of the lung are freed. The lung, of course, then collapses, and the wound is closed without drainage.

**Pneumothorax.** The indications for the use of the methods to introduce artificial pneumothorax were discussed at length two years ago, and since then numerous articles have appeared in the literature which it hardly seems necessary to abstract. The method has its ardent advocates and its opponents, but, as one writer has expressed it, it is comparable to surgery in malignant disease; while there may be numerous failures, yet the method has more cures and partial cures to its credit than any other method of treating this class of cases.

I have abstracted a few articles that seemed of especial interest. Adelung[1] discusses the sites for pneumothorax puncture. He states that autopsy findings have shown us that at the right apex where adhesions are usually situated, they will occur posteriorly six times as frequently as anteriorly. It is impossible to determine beforehand with any reasonable degree of accuracy whether pleural adhesions are present or not. For this reason he advises an anterior supranipple puncture and states that it is not dangerous if one keeps away from the sternal border one inch and does not pass the needle through the thickness of the lung. He has made 77 punctures, and has never encountered the least suggestion of injury to important bloodvessels. I feel that such statements are unwise, however, and one should constantly bear in mind the occasional occurrence of air embolus. A number of them have been reported in the literature this year.

An interesting article has appeared by Boit,[2] who discusses the physiology of the pleural endothelium. He concludes that the pleural lining is a resorbing membrane and a protection to the pleural cavity and the lung. It is quite efficient in overcoming infection, destroying bacteria by means of phagocytosis and bactericidal substances. But the pleural endothelial cells are highly organized and easily injured, and he believes the frequent occurrence of pleural exudates following operations or even injections of nitrogen gas is due to this depression in the resistance of the cells.

A good deal of attention has been paid to the effusion occurring after nitrogen injection, and Peters[3] believes that given the proper amount of time, practically 90 to 100 per cent. of cases operated on will show varying amounts of fluid. He mentions a number of factors in the occurrence of this effusion, such as separation of the pleural surfaces, the unphysiological position of the pleura, and the irritative effect of the gas pressure on the pleura.

Peters believes that the fluid has not the advantages often claimed

[1] Interstate Medical Journal, 1915, xxii, 846.
[2] Beitr. z. klin. Chir., 1914, xciii, 326.       [3] Medical Record, 1915, lxxxviii, 601.

for it. He does not think much of the formation of antibodies therein. He thinks that the complication is undesirable, disagreeable, even dangerous. He divides the effusions into serous and purulent, the latter being divided into those showing no organism except the tubercle bacilli and those showing a mixed infection, usually the staphylococcus. He leaves the effusion alone as long as no pressure effects are being produced, unless the effusion is becoming rapidly absorbed, in which case a further injection of gas should be given to prevent adhesion of the pleural surfaces. In those effusions showing tubercle bacilli, he aspirates whenever a sufficient amount is formed, and if there is a tendency to thick pus, a 2 per cent. formalin and glycerin solution is introduced. He states that in the mixed infection cases he has tried aspiration with the introduction of a formalin and glycerin solution and pursued a policy of watchful waiting, only to find that ultimately it became necessary to put in drainage and leave a discharging sinus. He regards the prognosis of the fluid cases as good, except where mixed infection occurs. He has operated upon 110 patients, of which 32 developed fluid in the chest, and of these, 12 became purulent. He reports that in a careful search of the foreign literature he found, in a series of 700 cases, purulent exudate present in 56, or 8 per cent. He then wrote to a number of physicians in America, and, from the replies, tabulated the results, and obtained 557 cases, of which 16 per cent. developed fluid and 3 per cent. became purulent.

Peters believes that, from his own experience and from closely following the literature, the infection with pus organisms and with the tubercle bacilli must be looked for from within. That technic plays an important role there can be no question, but when one adheres closely to the technic for major operations, it seems hardly possible that the fault could lie there.

In his conclusions, he thinks the percentage of pleural exudate is so small that we can consider the complication a negligible factor where artificial pneumothorax is indicated.

Woodcock[1] discusses the dangers of artificial pneumothorax and tabulates them under the headings of (1) shock, or irritation reflex; (2) injury to the lung by puncture; (3) injury to the lung by pressure; (4) inflammatory sequelæ to trauma of the tissue; and (5) excitation of disease elsewhere. He especially points to embolism and refers to the literature, giving a translation of some of the cases reported by Brauer and Spengler in their monograph. He states that we may safely say that the danger is slight in diseases external to the lung and almost negligible outside the costal pleura. In lungs and in pleuras grossly diseased, the veins, superficial and deep, are thickened, stiff and enlarged. A tear of these structures may result in a sucking in of gas. Woodcock

mentions a case in which he injected gas, together with two ounces of paraffin each time until the patient has had a pint. He states that he frequently uses paraffin in chronic cases after a well-marked gas feeding as it is not readily absorbed, creates new pleural surfaces, the pleura is eventually thickened, and obliteration of the pleural cavity may follow.

**Foreign Bodies in the Lungs.** Richards[1] reports a case in which the primary diagnosis was suggested by a blood examination. The patient was a man, twenty-five years of age, who since early childhood had occasional attacks of asthmatic breathing, bronchitis, and chills. Since 1910 he suffered from occasional attacks of pain, chills and fever of short duration, and with only a suggestion of cough but with a moderate steady leukocytosis and with no definite physical signs. Richards had an x-ray examination made which disclosed a tack in the right bronchus. There was no history as to when the tack entered the lung, nor did the patient remember ever having swallowed anything of the kind. Dr. Chevalier Jackson located the tack and removed portions of it through the bronchoscope. No reaction followed and no chills or any trouble with the lung has occurred since.

During the past year a patient was sent to the University Hospital from the Phipps Institute. She was a girl, six years of age, who, for four years, had been suffering from cough, expectoration, and attacks of fever. Her mother stated that she had been diagnosed by fourteen physicians as having tuberculosis of the lung. At the Phipps Institute a bronchiectatic cavity was suspected, and for the first time an x-ray ordered. The x-ray revealed the presence of a shawl pin two and a half inches long in the left lung. There was no history of the child having swallowed this. There was evidence that there was an abscess around the pin. She was admitted to Dr. Frazier's service and I operated on her in two stages. At the first operation a resection of a portion of the seventh rib was done, but upon opening the pleural cavity there were no adhesions found, and a pneumothorax developed. The lung was quickly grasped, however, and sutured to the edge of the opening. Five days later, with the cautery, an incision was made in the lung, an abscess found and evacuated, and the pin removed. The child has done very well, gaining greatly in weight and strength, but a sinus has persisted to the date of writing (two months after operation).

I also found another case recorded by Childs,[2] where a patient had several teeth extracted. A harassing cough was soon noted which persisted for several weeks, and she was sent to Colorado for tuberculosis of the lungs. There an x-ray examination revealed the root of a molar tooth near the second bifurcation of the lower right bronchus.

[1] Journal of American Medical Association, 1915, lxv, 238.
[2] Interstate Medical Journal, 1915, xxii, 604.

An interesting point in the technic of removal of certain foreign bodies is advanced by Jackson.[1] This method was applied in 4 cases successfully, and is effectually illustrated in the accompanying diagram.
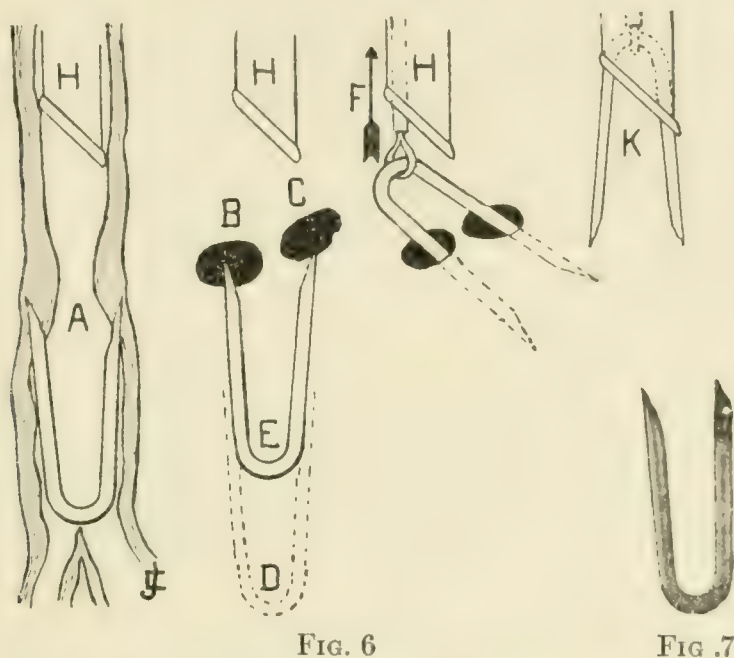


FIG. 6                                FIG. 7

FIG. 6.—Schema illustrating a new method of removal (by version) of bronchially lodged staples or double-pointed tacks. *H*, bronchoscope; *A*, swollen mucosa covering points of staple; *E*, the staple has been manipulated upward (*D* to *E*) with bronchoscopic lip and hooks until the points are opposite the branch bronchial orifices *B*, *C*. Traction in the direction of the dart *F*, by means of the rotation forceps, counterpressure being made on the points of the staple, the points enter the branch bronchi and permit the staple to be turned over and removed with points trailing harmlessly behind (*K*).

FIG. 7.—Showing actual size of staple removed from the right lung, bloodlessly through the mouth, by bronchoscopy, after version as shown in Fig. 6.

**Empyema.** Last year I devoted considerable space to a discussion of this subject. This year a number of valuable papers have appeared of sufficient importance to warrant taking up the subject again.

In a symposium on Empyema and Pulmonary Abscess in the Combined Meeting of the Sections of Medicine and Surgery of the Massachusetts Medical Society, five papers were read, and were followed by an interesting discussion.

The medical aspects were discussed by Lord,[2] who spoke briefly of empyema and more fully of abscess. He practises thoracentesis in clear serofibrinous effusions when there are pressure symptoms or when the fluid is of large amount; and also when the effusion is of medium amount and has persisted for two or three weeks after a trial of other methods. In the borderline cases in which there is turbid effusion, he

[1] Journal of American Medical Association, 1915, lxiv, 1906.
[2] Boston Medical and Surgical Journal, 1915, clxxiii, 798.

determines the cause of the turbidity, and if there is merely an excess of polynuclear leukocytes, evacuation by thoracentesis may be sufficient to effect a cure, as noted in 15 of 27 cases in the Massachusetts General Hospital. This method of treatment is especially efficient where the turbidity, consisting of an excess of polynuclear leukocytes, is secondary to lobar pneumonia or due to pneumococcus. When the turbid fluid contains abundant or necrotic leukocytes and positive cultures for pneumococci, he considers operation usually necessary; streptococcus infections rapidly tend to become purulent and generally demand operation. He, of course, agrees that with frankly purulent effusion an immediate and free drainage of the pleural cavity is essential, except in those cases in which the pus is sterile on cultivation or contains tubercle bacilli.

In the discussion of these papers, Sears[1] made the interesting observation that an unresolved pneumonia is a pathological myth; most medical men, I think, would not agree with this statement. He also emphasizes an important fact, known to most surgeons, that the diagnosis of empyema is made by the fingers (absence of fremitus, dulness on percussion, and displacement of organs), and not by the ears; all sorts of sounds may be heard over the effusion in the chest. He states that when one is in doubt between a pleural effusion and a consolidation of the lungs, it is always the former.

One point only was discussed in connection with the diagnosis, *viz.*, the *x*-rays. Brown[2] stated that in acute or subacute pleural disorders, the employment of fluoroscopy, or visual examination with the screen, far exceeds in value the production of graphic records upon plates or films. In subacute and chronic cases, the *x*-rays reveal variant disposition of effusions, adhesions, malposition of the ribs, the proportion of serviceable vesicular tissue and the cardiac shadow.

The other papers in the symposium by Cotton and Lund and Whittemore will be considered a little farther on, after discussing some statistics from the Mt. Sinai Hospital.

Acute Empyema. A critical study of 299 cases of acute empyema of the thorax treated at the Mt. Sinai Hospital, New York (1903 to 1913), is presented by Wilensky.[3] Fourteen of these cases were tuberculous, actinomycotic or pyopneumothorax, with 6 deaths. Of the remaining 285, 76 died, a mortality of 26 per cent. It is interesting to note that last year, in discussing a series reported by Down, exactly the same number of cases was reported with the same number of deaths.

Wilensky compares his statistics favorably with certain others, but a further search of the literature would have revealed that most other recent collections of cases showed a lower mortality. This is of but

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[1] Boston Medical and Surgical Journal, 1915, clxxiii, 814.        [2] Ibid., 802.
[3] Surgery, Gynecology and Obstetrics, 1915, xx, 501.

little importance because we are all in agreement with the main contentions made by Wilensky. The following table, showing the incidence of age, is interesting.

TABLE I.

| Age. | Cases. | Deaths. | Mortality. |
|---|---|---|---|
| Under 3 years . . . . . | 140 | 54 | 38.5 per cent. |
| 3 to 10 " . . . . . | 60 | 3 | 5.0 " |
| 10 to 20 " . . . . . | 26 | 4 | 15.4 " |
| 20 to 40 " . . . . . | 50 | 12 | 24.0 " |
| Over 40 " . . . . . | 23 | 9 | 39.0 " |

In the first year, 48 per cent. of the cases were lost; in the second, 31 per cent.; in the third, 41 per cent.

In 256 of the patients the empyema occurred as a complication of some previous affection of the lungs or pleura. The following represents the principal etiological factors given by Wilensky.

TABLE II.

| | Cases. | Deaths. | Mortality. |
|---|---|---|---|
| Lung abscess . . . . . | 6 | 5 | 83.3 per cent. |
| Enterocolitis . . . . . | 5 | 3 | 60.0 " |
| Pyopneumothorax . . . . | 7 | 4 | 57.1 " |
| Metastatic . . . . . | 16 | 8 | 50.0 " |
| Primary in pleura . . . . | 33 | 7 | 21.2 " |
| Pneumonia . . . . . | 198 | 43 | 21.2 " |
| Tuberculous . . . . . | 6 | 1 | 16.7 " |

The 5 cases of enterocolitis occurred in infants, the infection coming direct from the bowel by way of the blood or lymph stream, or else the empyema was metapneumonic. Wilensky remarks that when infants are ill with empyema during the summer months, enterocolitis is a frequent complication.

In the table, which I have given above, it will be noticed that the tuberculous empyema shows a very low mortality, but Wilensky also believes that the infected pleural effusions are probably primarily tuberculous in origin and, if these are added to the definitely tuberculous, there is a total of 16, with 7 deaths, almost 50 per cent.

Wilensky next discusses the pathology and bacteriology of empyema at some length. Most of the cases were metapneumonic, and he objects to the division of empyemata appearing after pneumonia into metapneumonic and parapneumonic, believing that one is unable to distinguish clinically between the two. Those empyemata which are due to the rupture of intrapulmonary foci of suppuration are dangerous because of the frequency of bronchopulmonary fistulæ which prevent healing of the empyema sinus until the opening in the bronchus has closed. Tuberculous empyemata usually results from rupture of the

caseating focus in the lung into the pleura, or from the caseation and rupture of pleural tubercles. In rare instances, a focus in a rib may rupture into the pleura.

Wilensky reported 9 interlobar empyemata in his series, and 3 cases of empyemata necessitatis. He also calls attention to the occurrence of localized or interlobar empyemata which are surrounded by clear fluid in the free portion of the pleural cavity, and also to cases in which the pleural cavity is divided by adhesions into several loculi, some of which contain pus, while others contain clear fluid. These have been described by Koninger under the title of mantell-ergüsse, who considers them as sympathetic effusions similar to that of the collateral edema around an abscess in the soft parts. Bacteriological examination revealed the pneumococcus to predominate greatly in the pleural exudates examined in the Mt. Sinai Hospital, with the streptococcus in second place. Comparison of the bacteriological findings to the mortality in true empyema revealed the following. I have omitted all but the three leading organisms:

TABLE III.

|  | Cases. | Deaths. | Mortality. |
|---|---|---|---|
| Pneumococcus . . . . . | 66 | 14 | 21.2 per cent. |
| Staphylococcus aureus . . | 22 | 4 | 18.2 " |
| Streptococcus . . . . . | 30 | 1 | 3.3 " |

The low mortality in streptococcus infection is surprising, although this was also noted last year in the discussion of Werner's paper, where the mortality of pneumococcus infection was given as 26 per cent., and that of streptococcus at only 11 per cent. It is probable, of course, that the high mortality in the former is due to the coexisting pneumonia.

Wilensky next discusses the duration before operation, and I have added to his table a computation of mortality percentage:

TABLE IV.

| Age. | Cases. | Deaths. | Mortality. |
|---|---|---|---|
| Under 1 week . . . . . | 57 | 27 | 47.4 per cent. |
| 1 to 2 " . | 91 | 24 | 26.4 " |
| 2 to 3 " . | 46 | 10 | 21.7 " |
| 3 to 4 " . | 31 | 7 | 21.3 " |
| 4 to 5 " . | 18 | 3 | 16.7 " |
| 5 to 6 " . | 9 | 1 | 11.1 " |
| 7 to 8 " . | 13 | 1 | 7.7 " |
| 2 to 3 months . | 17 | 3 | 18.0 " |
| 3 to 4 " . | 12 | 4 | 33.3 " |
| 4 to 5 " . . . . . | | | |

The gradual decline in the mortality percentage, the longer the pus has been present in the chest is of peculiar interest, but, as Wilensky

states, should not lead to unnecessary delay because delay means the formation of rigid uncollapsible cavities and chronic sinuses with numerous dangerous operations. It would seem, however, that one should wait some days before operating on acute cases.

A long list of complications is mentioned, of which pneumonia (23 cases with 19 deaths), middle-ear suppuration, and metastatic subcutaneous abscess are the most frequent. The patients averaged forty-four days in the hospital.



FIG. 8.—Superficial lung abscess communicating with the intrapleural space by a small opening. Drainage is insufficient and retention occurs.

*Results.* Fifty-three per cent. of the patients were cured after the first operation; 28 per cent. represented the total mortality; 12 per cent. of the patients were improved; and 7 per cent. were not improved. Whittemore,[1] in reporting 269 cases of acute empyema from the Massachusetts General Hospital, traced 154, of which 54 died after operation (20 per cent.), and of the 100 recovered cases, 68 per cent. were cured, 20 per cent. became chronic, and 12 per cent. died later, with apparently no connection between the cause of death and their empyema.

[1] Boston Medical and Surgical Journal, 1915, clxxiii, 168.

Wilensky places pneumonia, lung abscess, bacteremia, pulmonary edema, etc., as the leading causes of death, whereas Whittemore considers septicemia (bacteremia?) as the most frequent cause.

CHRONIC EMPYEMA. In a second paper Wilensky[1] reports 82 cases of chronic empyema sinus of the chest, treated in the Mt. Sinai Hospital from 1903 to 1913. The sinuses had existed for from two months to fifteen years, and he was able to divide the cause of non-healing into four groups:
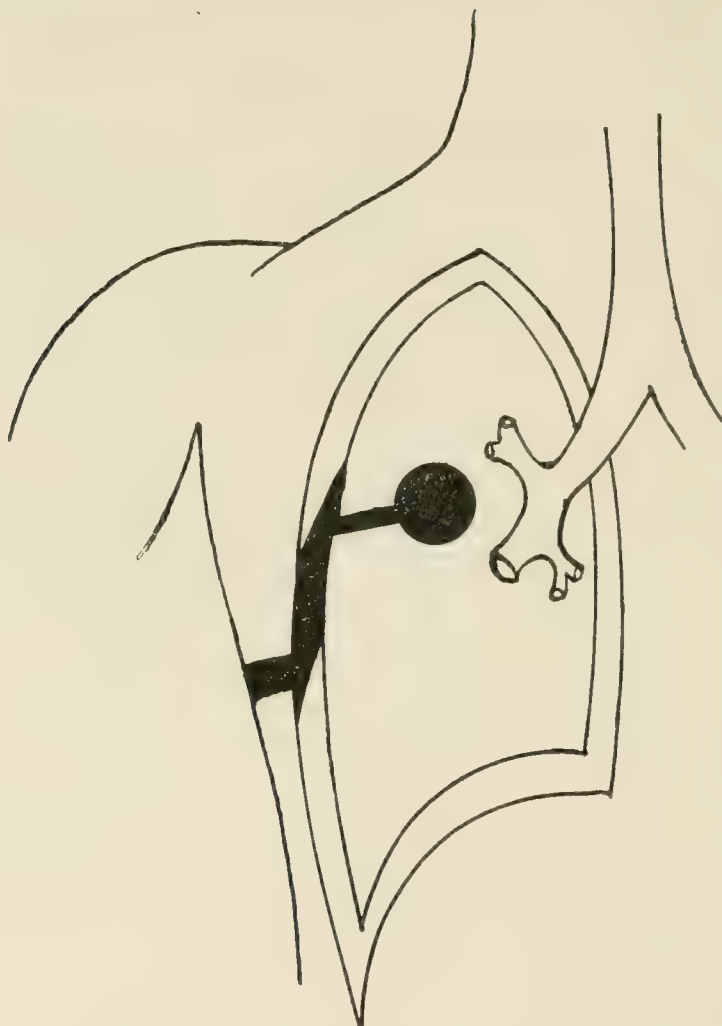


FIG. 9.—Deep lung abscess communicating with empyema sinus by a fistulous tract. Drainage insufficient. Pulmonary abscess occurs or rigid uncollapsible wall.

1. In the chest wall. This included abscess or cellulitis of the skin around the sinus; abscess in a partly healed scar, or necrosis of the resected rib. The latter occurred six times. All of these causes were easily corrected.

2. In the pleura. The uncollapsible cavity is not only collapsible because of the bony thorax, but also because of the thick, almost cartilaginous, pyogenic membrane. In a few cases the cavity was divided into loculi by bands or adhesions, and, if the connection with the out-

side drainage became closed, secondary abscess formed, sometimes latent for months, and reappearing as so-called "new empyemata." In 43 cases an uncollapsible cavity existed. In 2 cases a foreign body such as a tube prevented healing.

3. In the lung. A pulmonary abscess may be the cause of the empyema and, with or without bronchial fistula, may continue the trouble. The diagrams are self-explanatory and show the types referred to in Wilensky's paper. The sinus may be diagnosed by the injection
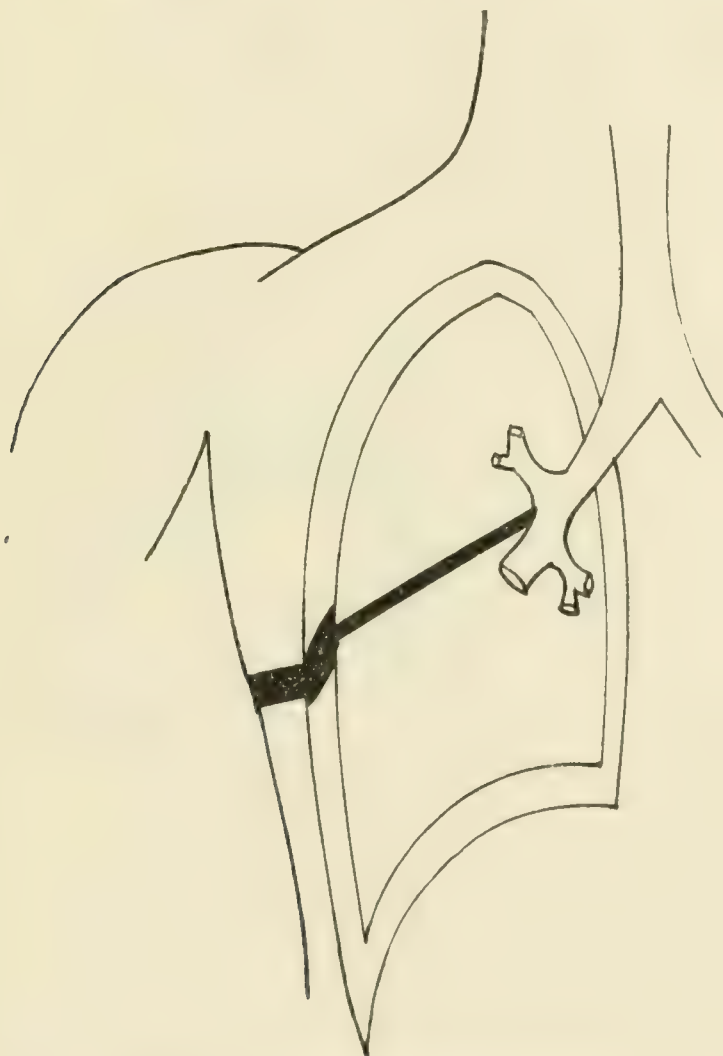


FIG. 10.—Bronchopulmonary fistula.

of bismuth and demonstration by the *x*-rays, although it is easily suspected if the patient appreciates the fact that with inspiration and expiration air passes inward and outward through the sinus in the chest wall in addition to the normal channel. This complication represents 7 per cent. of the cases.

4. The general condition of the patient. Chronic septic states, marantic conditions in infants, and the debilitating effects of tuberculosis or syphilis may influence the prognosis.

Of the 82 cases of this series, 68 per cent. were cured after one or

more operations, and 7 per cent. died. Wilensky believes that the
majority of cases of chronic empyema can be prevented by proper
attention to conditions which were present, and are not remedied at
the primary operation. Twenty-five per cent. owe their chronic sinuses
to faults in the after-treatment.

This paper is evidently leading up to the papers of Lilienthal which
I will refer to later.
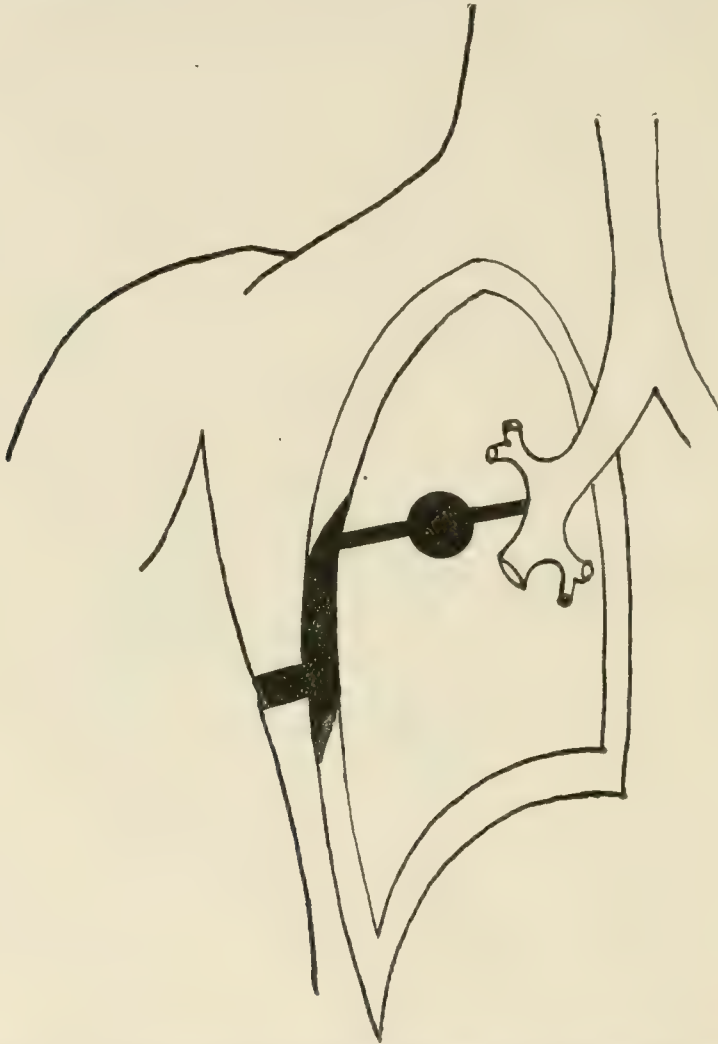


FIG. 11.—Bronchopulmonary fistula with intermediary abscess.

*Treatment.* The following discussion is based on the papers of Wilen-
sky, on the papers and remarks of Cotton, Lund, Homans, Stone, and
Boothby, in the Boston Symposium, and on the recent papers of Lilien-
thal.[1]

Cotton operates in this way: He resects three-fourths to one and a
half inches, usually of the ninth rib, just below the tip of the scapula,
opens the pleura sufficiently to admit a finger to sweep about and
loosen the adherent fibrin masses, and then turns the patient on his

[1] New York Medical Journal, 1915, ci, 191; Annals of Surgery, 1915, lxii, 309.

side so that he can cough out this fibrin. A rubber tube of not less than one-third or more than three-fourths of an inch, fenestrated, is introduced well into the cavity and held by a safety-pin outside the chest, after suture of the wound. A square of rubber dam is stretched over the drainage tube, which protrudes through it, of course, held flat by adhesive straps, and by a film of glycerin between the skin and rubber. An arrangement like that in the illustration is then used to produce suction. Later, Cotton removes the suction apparatus, stretches a square of rubber dam over the tube end, so as to have a valve which shuts on expiration and opens to let the pus out on inspiration. The patient is given the usual Wolff bottles to blow. Cotton evidently rarely has occasion to do the Schede, Estlander, or Delorme operations in long series of cases. He is rather unfair in his reference to Fowler.

Lund resects the rib in such a way that the resection is done well above the level of the incision in the skin. The skin flap formed by the dissection is then used as a valve. Last year I quoted Lund's paper on decortication in which he reported 7 cases. In the present contribution he states that he has had 3 more, but does not mention the details.

**Decortication.** Lund uses endotracheal anesthesia in these cases enabling him to blow up the lung during the operation, to see the effect of what has already been done, and to determine as to the necessity of future procedures. His method of operating was discussed last year. As he himself usually operates in acute empyema by resecting portions of the ninth or tenth ribs, in the posterior axillary line, he extends his incision from the sinus, vertically, resecting an inch of the eighth, seventh, sixth and fifth ribs, cutting the pleura. If the primary drainage opening is farther in front, he suggests carrying the incision backward and upward into the intercostal space, spreading with a rib retractor, as suggested by Homans; but, later in the discussion, Homans repudiated this method and stated that it was dangerous, owing to the grave danger of tearing into the mediastinum. Homans now excises several ribs in place of his former method.

In the discussion, Homans emphasized the use of a fairly long tube in drainage, and he leaves it in until the large cavity becomes a broad, flat cavity, the flat cavity becomes a broad ribbon, and the broad ribbon becomes a narrow ribbon and finally closes. Homans also believes that it is not necessary to remove the visceral pleural membrane unless it is so placed as definitely to hold down the borders of the lung; and he always tries better dependent drainage before proceding to decortication. He states that in doing this he reverses a former belief, but that now he is not quite sure enough of the indications for decortication to propose it unless proper drainage has proved a failure.

A rather new method of drainage has been proposed by Leschke.[1] Under local anesthesia two cannulas are thrust through an interspace fairly low down over the empyema; rubber catheters, the ends of which are cut obliquely and with lateral openings near the tips, are inserted through the cannulas and the latter withdrawn. One catheter is then connected with an irrigator and the other with a tube filled with water which is emersed in a bucket of water beside the bed. The pleural cavity is then irrigated slowly, so as to avoid variation of pressure, with physiological salt solution. Irrigation should be continued until the water comes out clear, and repeated three or four times daily. The catheters should be clamped when the irrigator and syphon tubes are disconnected between operations in order to prevent the entrance of air. Leschke evidently does not fear the ill effects usually observed from irrigating the pleural cavity.

Recently, Edward Martin[2] has proposed the introduction of a trocar and cannula between the ribs, to be followed by silver-tube drainage, the flanges of the tube being stitched to the skin by means of silver wire. Immediate suction and pulmonary exercises are advocated.

In the discussion, Jopson states his preference for large openings in order to get proper drainage.

**Decortication for Acute Empyema.** Stimulated, no doubt, by the findings of Wilensky and others who have investigated the end-results in Empyema, lilienthal has advanced a very radical method for the treatment of empyema in the early acute stage. The operation is usually an exploration of the thorax through a large opening, with primary mobilization of the lung. In the first paper,[3] he reported 7 cases with 2 deaths. In the second paper[4] the results of 23 operations are reported, of which 4 were fatal (17 per cent.). The following is the operation as at present performed: "A transpleural incision is made in the seventh or eighth interspace close to the upper border of the rib from the angle almost or quite to the cartilage. Part of the latissimus dorsi and serratus magnus muscle must be divided, and, in the adult, such an incision may be eight or nine inches long. Preferably local anesthesia is employed up to this point, to be followed now by nitrous oxide and oxygen. Ether had better be avoided, owing to the danger of irritating an already diseased lung. The mechanical rib-spreading retractor is then placed in position. This instrument will widen the intercostal space to four inches or more, permitting a thorough inspection of most of the interior of the thorax. The intrathoracic procedure will depend upon what is disclosed at this exploration."

[1] Berliner klin. Wchnschr., 1915, lii, 549.
[2] Meeting of the State Medical Society of Pennsylvania, September 21 to 24, 1915.
[3] New York Medical Journal, 1915, ci, 191.
[4] Annals of Surgery, 1915, lxii, 309.

The lung may be free and its fissures visible, in which case it is necessary to remove the loose flakes of fibrin and close the chest with drainage. The lung may be free everywhere except over the surface of the diaphragm, and a sacculation of pus may be encountered and evacuated. A tender adhesion toward the mediastinum may cover a pocket of pus. Interlobar collections may be detected and evacuated. In some cases a bulging and rigid diaphragm may suggest a complicating subphrenic abscess, and puncture will lead to incision and evacuation. In other cases the open thorax discloses the pleura of the lung covered by a grayish or greenish membranous exudate which obliterates every landmark. The chest cavity may not show even a bulging to indicate the location of the lung as it lies compressed against the mediastinum, the spinal column or the chest wall. These are the cases which, treated by the old methods, would be followed by delayed healing, by fistulæ, or by contractures of the thorax. In these cases all bleeding-points must be secured, so that the wound is dry, and then, after wiping away the pus and loose fibrin, the fibrinous coating of the pleura is incised and separated from the lung in the manner shown in the illustrations. The tissue is not vascular and will bleed little, if any, and the lung will bulge out through the opening made in its retaining membrane. Tough adhesions between the lung and the chest wall should not be separated, owing to the dangers of hemorrhage attending their tearing away. In the left chest the pericardium must be guarded from injury. Lilienthal corroborates the statements previously made in this chapter, whereby the retraction of the ribs may tear the pericardium, and he also warns against tearing of the diaphragm.

After completing the intrathoracic work, the retractor is removed and the rib approximated by suturing the latissimus and serratus muscles with catgut. This will draw the ribs together to a certain degree but not enough to interfere with drainage. Lilienthal closed the wound with silk, except at the point, usually in the middle axillary line, where drainage is to be provided. A short tube, or two or three, may be used to promote drainage, but often the operation itself will suffice without tubes. The ribs will come together in from five to ten days.

In the after-treatment, the lungs should be expanded by blowing exercises, and open-air treatment is of the greatest value.

Of the 17 patients operated on who recovered, 12 are well; 1—a tuberculous case—is unhealed; and 4 are still in the hospital but may be considered as convalescent. There has been no thoracoplasties on these patients.

**Lung Abscess**. Scudder,[1] in 1914, reported 16 cases of lung abscess from the Massachusetts General Hospital, seen since 1906. For some

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[1] Boston Medical and Surgical Journal, 1914, clxxi, 523.

reason I overlooked this paper last year. The following table contains the important details of the cases:

CASES OF ABSCESS OF THE LUNG SINCE 1906.

Reported by Dr. C. L. Scudder from the Massachusetts General Hospital Clinic.

| No. | Cause. | Dura-tion. | Seat. | Opera-tion. | Surgeon. | Imme-diate result. | Remote result. |
|---|---|---|---|---|---|---|---|
| 1 | Pneumonia | 8 days | Rt. base | 1 stage | C. L. S. | D | Abscesses of liver and lungs. |
| 2 | Postoperative | 3 wks. | Rt. base | 2 stages | W. W. | R | Cured—six months. |
| 3 | Pleurisy | 1 mo. | Lt. base | 2 stages | S. R. | R | Left hospital in good condition. |
| 4 | Duodenal ulcer | 1 mo. | Rt. base | 1 stage | C. L. S. | R | Local empyema (through bron-chus). |
| 5 | Actinomycosis | 7 wks. | Lt. base | 2 stages | C. L. S. | R | Left hospital in good condition. |
| 6 | Pneumonia | 2 mos. | Lt. base | 2 stages | F. C. C. C. S. | D | No relief at any time. |
| 7 | Pneumonia | 2 mos. | Rt. base | 2 stages | C. L. S. | D | Postoperative empyema; septi-cemia. |
| 8 | Pneumonia | 4 mos. | Rt. base and liver | 3 optns. | F. C. F. B. H. | D | Abscesses of lung, liver, and brain. |
| 9 | Unknown | 6 mos. | Lt. base | 2 stages | C. A. P. | R | Unimproved. |
| 10 | Pleurisy | 9 mos. | Rt. base | 3 optns. | C. L. S. | D | Abscess lung; mucous colitis. |
| 11 | Pneumonia | 11 mos. | Lt. base | 2 stages | W. W. | R | Cured—one year. |
| 12 | Unknown | 1 yr. | Rt. apex | 2 stages | C. L. S. | R | Left hospital in good condition. |
| 13 | Pneumonia | 1 yr. | Lt. base | 2 stages | S. R. | R | Cured—one year. |
| 14 | Pleurisy | 3 yrs. | Lt. base | 2 stages | C. L. S. | R | Left hospital slightly relieved. |
| 15 | Duodenal ulcer | 4 yrs. | Rt. base | 2 stages | C. L. S. | R | Cured—six months |
| 16 | Pneumonia | 6 yrs. | Lt. base | 2 stages | C. L. S. | R | Unimproved. |

It will be seen that 11 patients recovered and 5 died, a mortality of 45 per cent. Whittemore[1] combines this report with the one published by Lord in 1906, as follows:

"There were 27 cases operated on: 8 are entirely well; 2 did not improve following operation; 2 have died since leaving the hospital, cause of death not known; 8 have not been traced; 7 died following operation, giving a mortality of about 25 per cent. Three of these died from multiple abscess of the lung, 1 from multiple abscess of the lung and liver, 1 from multiple abscess of the lung, liver and brain, 1 from septicemia, and in 1 case the cause of death is not known."

In the Boston Symposium, Lord, in discussing abscess and gangrene, based his remarks upon 185 cases collected from the records of the Massachusetts General Hospital and seen in consultation. In 85 of these the cause was not wholly clear, but from the insidious onset, or occurrence following an acute infection of the upper portions of the respiratory tract, an origin from bronchopneumonia was suspected. Thirty cases followed lobar pneumonia. Lord then makes the interesting observation that abscess is not an infrequent finding at autopsy in cases of bronchopneumonia or lobar pneumonia. Thus, in 85 cases of bronchopneumonia coming to autopsy at the Massachusetts General Hospital, abscess was found in 16; and in 51 cases of lobar pneumonia, abscess was found in 14. Another group, represented by 25 cases, are those in which the cause is the aspiration of infected material into the deeper portions of the respiratory tract. "In this group are included

[1] Boston Medical and Surgical Journal, 1915, clxxiii, 811.

such abscesses as arise after etherization for operation upon parts of the body remote from the respiratory tract (10 cases), the extraction of teeth (5 cases), the removal of tonsils (2 cases), and adenoids (1 case), the inhalation of foreign bodies (4 cases), and submersion (3 cases). The unfortunate occurrence of pulmonary abscess in this group is not always avoidable, but its incidence will diminish with greater caution in selecting the time for operation under ether, and the postponement, when possible, of operative interference, until the respiratory tract is clear of infection, greater care in the prevention of inhalation of blood or other material during operations about the mouth and the nasopharynx and the early removal, with the aid of bronchoscopy, of inhaled foreign bodies."

In the diagnosis, Lord believes that there are three signs which are most important; first, dulness on percussion, which may or may not be accompanied by other physical findings; second, the evidence of a circumscribed increase of density on $x$-ray examination; and third, the demonstration of elastic tissue with an alveolar arrangement in the expectoration. Tuberculosis should be thoroughly excluded, and this is generally easy, because a pulmonary process which has progressed to the stage of tissue destruction without showing tubercle bacilli in the sputum, is not likely to be tuberculous. Lord cautions as to the use of the needle for exploratory puncture. In abscess or gangrene, bloodvessels lining the wall or traversing the lumen of the cavity may be unsupported by any tissue and their injury may be followed by severe and even fatal hemorrhage. In addition, the upward displacement of the diaphragm may allow the needle to perforate it and to infect and lead to a fatal peritonitis. In a series of 31 cases not operated on, the mortality was 70 per cent., and Lord states that in the remainder, while there may be relief of the more urgent symptoms, yet there is only uncommonly a complete recovery from the suppurative process.

"The indications for or against operation are difficult to formulate and each case must be decided on its merits, but, as a general rule, it may be stated concerning the acute cases that in the presence of a small process, without marked symptoms of sepsis, with purulent and not foul expectoration, and without a large amount of elastic tissue and lung shreds, an expectant policy may be followed. If, after observation for three to four weeks, recovery or marked improvement does not occur, operation should be considered. Operation is indicated, on the other hand, with an extensive process, marked sepsis, putrid sputum, and abundant elastic tissue or lung shreds. The exigencies of the individual case determine the propriety of operative interference in cases which have lasted for months or years. The condition may be intolerable to the patient or so menacing to life as to justify surgical intervention, even though little more than partial relief may be expected. Circumscribed, inextensive and single lesions offer a greater hope of success."

Whittemore refers briefly to the technic. He operates as follows: "Endotracheal anesthesia is preferred. A large skin and muscle flap should be turned up and a section from three or four ribs in the region of the abscess removed. The intercostal muscles should then be cut away and the field made perfectly dry. If the pleura is not adherent, and it frequently is not, the lung can be seen moving under it. Two or three sponges are then laid against the exposed pleura and the skin and the muscle flap sutured into place. It is not necessary to suture the lung and pleura, but it may be done before laying the sponges on.

After three or four days, at the second stage of the operation, the pleura will be found to be firmly adherent to the lung. An incision is made through the pleura and into the lung, and the lung explored for abscess. One can explore with a trocar, but I feel it is better to use one's finger, as a trocar may puncture a vessel and cause severe hemorrhage. When one is lucky, one opens into an abscess with frank pus. However, in a few cases an indurated mass is broken into, from which comes foul-smelling, bloody material, with perhaps a very little pus or even none at all that is visible. A soft-rubber drainage tube should be fastened in and the skin partly closed."

**Bronchiectasis.** Davies[1] reports the results in a case of bronchiectasis in which a branch of the pulmonary artery was ligated. A preliminary nitrogen injection was given in order to abolish the bronchial secretion and lessen the toxemia. Four days later portions of the fourth and fifth ribs were resected, and the branches of the pulmonary artery and the lower lobe ligated. A few months later the patient was able to go to work and had only a slight cough.

**Suppurative Pericarditis.** The various statistics differ as to the frequency of suppuration in pericarditis, but when it occurs, the problems both of diagnosis and treatment are quite interesting. At first the fluid fills the sinuses in the sac, one lying to the right of the large vessels at the base of the heart and the other situated along the right posterior edge under the sternal angle of the fifth intercostal space. If the amount of pus is small, the $x$-rays only will show the lesion. As the exudate increases and fills the sac, the usual physical signs commonly described are observed, and finally, when the pressure of the exudate becomes still greater, the intrapericardial pressure exceeds the intraoricular pressure and produces compression of the heart. Cyanosis, pain in the arm, precordial pain and oppression and edema may be seen. A minute description of the symptoms and a review of the methods of treatment of this affection are given by Rhodes.[2] He emphatically condemns aspiration of the pericardium, either in treatment or in diagnosis; in diagnosis, it is superfluous because a careful study of the case, of the $x$-ray, of the leukocyte count, and of the temperature chart will suffice; in treatment, it is not attended by success.

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[1] Proceedings of Royal Society of Medicine, 1915, viii, Clinical Section, 32.
[2] Annals of Surgery, 1915, lxii, 660.

In the case reported, a hockey-stick incision was made, starting from the third costal at the left sternal margin, downward and curving outward along the seventh rib. The fourth and fifth costal cartilages and portions of the ribs were resected periosteally, the pericardium was opened and a large amount of pus evacuated. He drained his case with rubber tissue owing to the fear of necrosis of the heart by a rubber tube. The sac drained well; daily irrigations were practised by the patient for eight days after operation. He also reports a case operated on by Ransohoff in which the sac was opened by an incision parallel to the left border of the sternum and margin of the left ribs with resection of two inches of the sixth rib. An extensive bibliography is appended to this article.

I operated upon a patient last summer who was suffering from a mild degree of suppurative pericarditis. The diagnosis had been made by the symptoms and the $x$-ray, and confirmed by an exploratory puncture. A small incision was made somewhat after the method of Rehn, and the edge of the sternum and the adjoining seventh costal cartilage removed with rongeur forceps. It was necessary to detach the abdominal muscles from the cartilage. The costoxiphoid space was then opened up, and, at the distance of about one inch, the pericardium was found, caught with Allis's forceps, and opened. About 300 c.c. of fluid was evacuated. This was turbid and bloody. A great many fresh adhesions were felt holding the heart in place to the pericardial sac and these were loosened partly with the finger and partly with a pair of long-bladed clamps. A rubber drainage tube was introduced and sewed to the pericardium. The patient made an interrupted recovery, drainage was removed in a few weeks, and he has remained well at this date (December 15, 1915). In another case I would probably use one of the rubber-spool tubes for drainage for fear of necrosis of the heart which has been reported a number of times.

**Tumors of the Mediastinum.** Malignant disease of the mediastinum is probably not so rare as is generally supposed. It is essentially a disease of early middle life, occurs most frequently in males, the anterior mediastinum is the usual place of origin, and both sarcoma and carcinoma are encountered. Two papers have appeared recently upon this subject by Haines[1] and by Ross.[2] The first named reported 2 cases and discussed the condition; the latter reported the data obtained from a consecutive study of 60 cases seen at autopsy. The symptomatology is the most interesting part of Ross's paper. He states that it is quite impossible to portray a clinical picture which will hold good in every case as the mode of onset, severity and duration of practically every symptom differ. The following appears to be of some diagnostic significance.

[1] Surgery, Gynecology and Obstetrics, 1915, xx, 542.
[2] Edinburgh Medical Journal, 1914, xii, 444.

Pressure symptoms were present in a greater or lesser extent in practically every case. Dyspnea was sometimes the first symptom, usually developing insidiously and sooner or later becoming very prominent. Dyspnea, out of proportion to the physical signs found, is very characteristic. Its chief causes were found to be pressure of a pleural effusion, pressure on the trachea or a main bronchus, vagal irritation or a plug of mucus blocking the lumen which is already narrowed by one of the above causes. He notices that when the vagus nerve is implicated, it is practically always only pressed upon and rarely infiltrated with the disease. Pain was usually present at some period, generally dull and aching but sometimes severe. The pain may be due to the presence of fluid, may be pleuritic, may be due to involvement of the intercostal nerves or to erosion of the vertebræ or sternum. Hoarseness was a common feature, dysphagia was rarely present and eye changes due to pressure on the sympathetic nerve were fairly frequent. The most common eye change was a contraction of the pupil from the very first on the affected side. Sudden edema of the face and neck was often an early symptom, and is of very great diagnostic significance. Emaciation was not present, fever never ranged over 100° F., and hemoptysis was seldom severe, although in 3 cases it was the actual cause of death. Percussion was found to be the most valuable and reliable of the physical signs, and in one-half of the cases a pleural effusion was present. An x-ray was found to be of great value in the hands of a skilled operator.

Forty-three of the cases died from exhaustion, 11 from asphyxia, 3 from hemoptysis, 2 from cardiac failure, and 1 from cerebral tumor.

In Haines's paper some remarks on treatment are appended. He has been experimenting with the operation devised by Milton, who divided the sternum longitudinally throughout its entire length, in order to remove a foreign body in the right bronchus. This may be modified, as suggested by Curtis, who limits the division to the manubrium.

Friedrich[1] has discussed this method and proposed its use in cases in which the intrathoracic tension has been increased by tumors, aneurysms, etc., leading to severe respiratory and circulatory disturbances; in other words, he uses it as a decompressive operation.

**Pulsion Diverticulum of the Esophagus.** These esophageal pouches, easily recognized from the symptoms and by the x-ray picture, are usually treated by operative extirpation. The operation may be difficult, however, when the diverticulum is small, and it may elude careful search. If insufficient tissue is removed the diverticulum may recur, or, if too much is removed, a stricture may leave the patient worse off than before. For these reasons the operation advanced by

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[1] Beit. z. klin. Chir., 1914, xciii, 312.

Gaub and Jackson[1] seems to be a noteworthy advance in the treatment of this condition.

They report 2 successful cases operated under endotracheal ether anesthesia. The technic is as follows: The esophagus is exposed in the usual manner and the wound kept clean and dry by careful hemostasis. An esophagoscope is then introduced down the esophagus and into the diverticulum. The latter is then pushed into the external wound. The surgeon siezes the bottom of the pouch with forceps, and the esophagoscope is withdrawn somewhat and pushed on down the lumen of the esophagus. The redundant portion is then amputated with careful precision. The wound is closed and dressed in the usual manner. The accompanying illustration illustrates the method of procedure.

**Fistula of the Esophagus and Bronchus.** An interesting case is reported by Beeler[2] in which a stereoröntgenogram gave the exact anatomy of the lower bronchial trunk area. The fistula was probably syphilitic in origin and was first manifested by difficulty in swallowing, hemorrhages, and choking spells.

Kelling[3] discusses 3 cases in which suppurating bronchial lymph glands perforated into the esophagus. There were no symptoms to attract attention until the perforation occurred, and then they suffered from pain between the shoulder-blades, cough without expectoration, fever, and the regurgitation of suppurating blood-stained masses when the patient reclined. There was no vomiting, however. In the cases reported, the clinical picture suggested gastric ulcer. In discussing the treatment, Kelling repeats the advice of previous observers to perform temporary gastrostomy, or, as in the case reported by Rehn, to open the mediastinum and remove the tuberculous glands. Kelling however, believes that the latter operation is not practicable when perforation has already occurred, but suggests the aspiration of the abscesses until cure is affected.

In this connection I might mention the report of Paunz,[4] who discusses the rupture of tuberculous glands into the trachea and bronchi. When such has occurred, tracheotomy should be performed at once, to be followed by tracheobronchoscopy from below, the caseous gland being then treated as a foreign body.

**Esophagospasm.** It is well known that most cases of cardiospasm are of nervous origin and the diagnosis is usually easily made by the history and *x*-ray examination. Dilatation is the usual operative measure proposed. In certain cases, however, this is not practicable, and certain operations have been done from the abdominal side after opening the stomach. Recently Ropke operated as follows: The abdomen was opened and the peritoneum split at the entrance of the esophagus into the abdominal cavity. The esophagus was then loosened

[1] Surgery, Gynecology and Obstetrics, 1915, xxi, 52.
[2] Journal of American Medical Association, 1915, lxv, 1178.
[3] Arch. f. Verhauungskr., 1915, xxi, 35.     [4] Jahrb. f. Kinderh., 1914, lxxx, 386.

and drawn down into the abdominal cavity until it was entirely free to a point above the dilatation. The abdomen was then closed. The patient was relieved at once and has remained apparently cured. Ropke thinks the result may be due to the rough handling of the esophagus and the destruction of the nervous element by the separation of the periesophageal tissues. The splitting of the muscles of the diaphragm may also have helped to remove a point of obstruction. A similar case was reported by Heller.
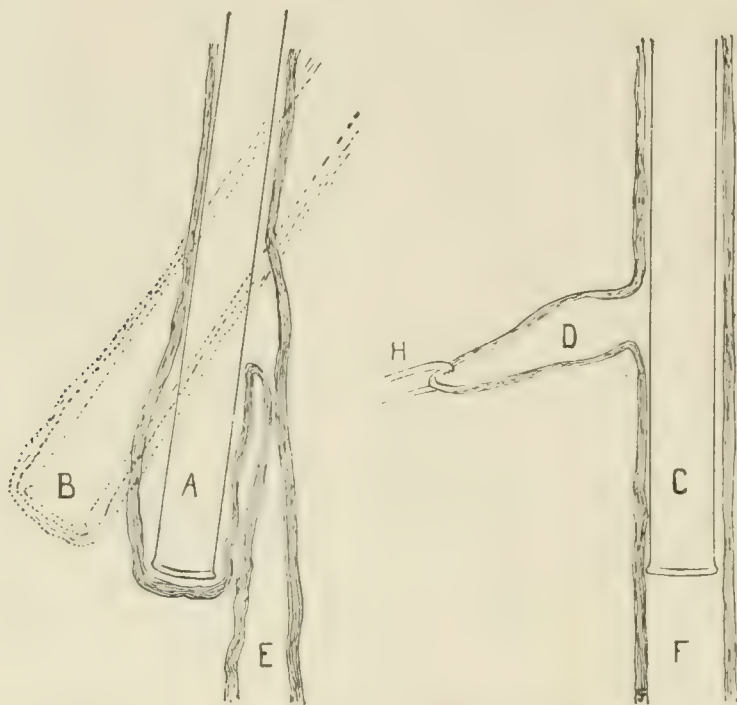


FIG. 12.—Schematic representation of esophagoscopic aid in the excision of a diverticulum. At *A* the esophagoscope is represented in the bottom of the pouch after the surgeon has cut down to where he can feel the esophagoscope. Then the esophagoscopist causes the pouch to protrude as shown by the dotted line at *B*. After the surgeon has dissected the sac entirely loose from its surroundings, traction is made upon the sac as shown at *H*, and the esophagoscope is inserted down the lumen of the subdiverticular esophagus as shown at *C*. The esophagoscope now occupies the lumen which the patient will need for swallowing. It only remains for the surgeon to remove the redundancy, without risk of removing any of the normal wall.

**Carcinoma of the Esophagus.** Two years ago I reviewed this subject extensively and recorded the details of a successful case reported by Torek. This author[1] has again contributed an interesting paper, in which a resumé of the operative treatment is given.

Meyer[2] has also contributed a complete paper upon resection of the cardia for carcinoma. Perhaps this subject does not properly belong in the domain of thoracic surgery, but as part of the operation was thoracic, and even cervical, some mention may be made of this paper at this time. It seems that but few cases of carcinoma of the esophagus have made an operative recovery.

[1] Annals of Surgery, 1915, lxi, 385.   [2] Ibid., lxii, 710.

Voelker,[1] in 1908, operated on a patient forty-two years of age entirely by way of the abdomen. The carcinoma was resected and an immediate end-to-end union made by Billroth's method No. 1. Kuemmel[2] also resected a portion of the cardia for cancer, the operation being done entirely within the abdomen. Immediate union being impossible, a T-tube was tied into the esophagus and into the stomach and the surrounding part packed with gauze. In 1910 Sauerbruch[3] had a similar case but worked through the thorax, the stomach being pulled up above the the diaphragm and the anastomosis carried out with Tiegel's button. In none of the above cases was the esophagus affected. In 1912 Zaaijer[4] resected the lower ribs in order to reduce the distance to the field of operation and performed gastrostomy. Later he excised the tumor and sutured the proximal stump to the skin in the axillary line. A rubber tube was then used to connect the esophageal and gastric fistulæ.

About the same time Ach[5] removed a large growth from the stomach and lower esophagus. He did the whole operation, including the gastrostomy, at one sitting. Details of this operation will be given later in discussing resection of the cardia.

The next case was reported by Torek[6] and was fully reviewed two years ago. This was the only case of carcinoma of the thoracic esophagus successfully operated on, and, in his last report, Torek states that the patient is well and free from recurrence, twenty and a half months after operation. A number of cases are scattered throughout the literature where the patient has lived a few weeks before succumbing to the results of operation.

It will thus be seen that the present state of surgery of esophageal cancer is very dark, but the persistent efforts now being made will sooner or later result in success. An early diagnosis is essential to successful treatment, and it seems as though only dysphagia and the appearance of the esophagus under the Röntgen rays are of any value.

Meyer[7] states that there are two factors essential for a successful issue of the resection of the malignant esophageal stricture. The first of these is to know "how to do the operation;" this is an accomplished fact today; and the second fact consists in the possibility of establishing an early diagnosis. He states that every patient who complains of difficulty in swallowing is to be considered a surgical case and should then have stereoscopic radiograms and fluoroscopic examinations made. The use of sounds is hardly to be commended, and at any rate they also should follow radiography. He prefers the Callman sound. Esoph-

[1] Verhandl. d. Deutsche Gessellsch. f. Chir., 1908, i, 126.
[2] Ibid., 1910, i, 96.        [3] Technik de Thorax Chir., 1911, p. 87.
[4] Beitr. z. klin. Chir., 1913, lxxxiii, 419.
[5] Beitr. z. Esophagus Chir., 1913, p. 68.
[6] PROGRESSIVE MEDICINE, March, 1914, p. 139.
[7] Annals of Surgery, 1915, xxix, 252.

agoscopy should only be done by one thoroughly trained in this work, and it is probable that the removal of a portion for microscopic examination does more harm than good.

Finally, exploratory thoracotomy has the same place in thoracic surgery as does exploratory laparotomy in abdominal surgery.

INDICATIONS FOR INTRATHORACIC RESECTION OF THE ESOPHAGUS. Torek states that for a case of carcinoma of the esophagus to be operable there must be no evidence of visceral metastasis, the disease must be circumscribed and limited to the esophagus, and the patient's general condition must be such as to stand the extensive operation. In one of his papers, Meyer[1] discusses the indications for operation and cautions against too great aggressiveness after the exploratory thoracotomy has been done. He compares the folly of attacking a growth which involves the tissues around the aortic arch to that of attempting to resect a carcinoma of the pylorus which has involved the pancreas and liver. He advocates radical operation in any part of the esophagus upon small circumscribed new growths, usually the rather benign squamous-cell epithelioma, and upon infiltrating carcinomas, except those situated behind the aortic arch.

A brief preliminary treatment is of value in clearing up any existing bronchitis, cardiac insufficiency, anemia, etc.

*Preliminary Operations.* It would seem that the anesthesia in these cases should be introduced by endotracheal insufflation.

It is necessary, in cases of cervical carcinoma, to improve the patient's nutrition and enhance his powers of feeding by preliminary feeding through a gastrostomy. Torek advises the Witzel or Kader method. Meyer criticizes the latter method in cases in which an infiltrating cancer is located in the lower end of the esophagus and cardia. He has seen cutting out of the sutures used with the formation of a fistula and believes that the Witzel or Senn method in this class of cases is preferable. If one hopes to connect the mouth with the stomach by a subcutaneous tube, provided the removal of the cancer has been attended with success, it would seem better surgery to plan for the lower end of this tube at the time of the first operation. The principal means of obtaining such a tube are by use of the colon or small intestine or the stomach (Jianu), for the lower portion, and by a plastic operation with the use of skin as in the von Hacker method in the upper part. Meyer states that the method of Jianu was previously reported by Beck,[2] of Chicago, in 1905. In this method an incision is made through both walls of the stomach a short distance from the greater curvature, and both edges sutured together again so as to form two stomachs, in one of which the loop is long and tube-like in character. This is pulled upward beneath the

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[1] Surgery, Gynecology and Obstetrics, 1915, xx, 162.
[2] Illinois Medical Surgery, 1905, vii.

skin with or without a connecting plastic to the esophagus in the neck. The method was illustrated in PROGRESSIVE MEDICINE two years ago, and I am repeating the illustration this year.

Meyer[1] states that he has done the Beck-Jianu operation six times without losing a patient. He mentions the following disadvantages:

"1. The persistence of the peristaltic wave in the new tube.

"2. The likelihood of the interference of the gastric secretion discharging from the tube opening, with plastic skin work, that may become necessary for the completing of the new antethoracic esophagus."

In order to avoid the upward peristalsis in the Beck-Jianu tube, he has proposed:

"(a) A transverse superficial cauterization with the Paquelin anteriorly and posteriorly in front of the base of the tube, to destroy the nerve supply. It remains to be seen whether this will do harm with reference to the nutrition of the tube.

"(b) To make the communicating opening of the tube with the cardiac portion of the stomach as small as possible, by converging the incision toward the major curvature.

"(c) To place, after completing of the second row of sutures, a widely approximating additional mattress suture at this spot, if necessary in a *double layer*.

"(d) To make a slight twist of the tube, according to Gersuny's[2] method."

In a recent article by Jianu[3] himself, these criticisms are answered.

"1. That peristalsis in the tube forces the food back so that the stomach is emptied in the wrong direction. This is due, not to peristalsis, for the tube is so placed that antiperistalsis occurs, but to the fact that the new esophagus is made to open much lower down toward the pylorus than it should.

"2. That the secretion at the upper end of the tube digests the skin around it. Where this occurs, it is a result of a technical error. The mucous membrane should be taken from the pyloric end of the stomach where it contains only mucous glands.

"3. That the new-formed esophagus was not long enough so that the upper end of it could be brought up under the clavicle. To avoid this difficulty, after the gastrocolic ligament is cut, the gastrolienic and gastrophrenic ligaments must also be incised."

EXCISION FOR THORACIC CANCER. For the present at least the method proposed by Torek and performed on the only successful case on record, should be followed. This operation requires an opening of the pleural cavity, but this is hardly avoidable at the present time. Ach[4] and Rehn[5] have been attempting to develop an extrapleural route, and their efforts are being watched with interest.

[1] Surgery, Gynecology and Obstetrics, 1915, xx, 169.
[2] Zentralblatt f. Chir., 1914, 000.
[3] Deutsche Ztschr. f. Chir., 1914, cxxxi. 897.
[4] Beitz. z. Esophagus Chir., 1913, p. 68.    [5] Esophagus Chir., Jena, 1914.

Torek's method is as follows:

The patient lies on the right side, the left arm up and well forward so that the scapula is out of the way of the incision. A cushion is placed under the right chest. An incision is made the entire length of the seventh left intercostal space down to the pleura, but not through it. The excision extends from the posterior end of the seventh intercostal space, between the angle and tubercle of the rib, upward to the third intercostal space. The skin and muscles are divided, exposing the fourth to the seventh ribs, inclusive. Towels are fastened to the edges of the incision by clamps. The vessels are clamped and tied. This step is done under general and local anesthesia, and while the vessels are being tied, general anesthesia is induced, the patient intubated, and insufflation anesthesia started. Moderate intrapulmonary pressure is used while the pleura is being opened. The pleura is opened in the seventh intercostal space and the operability of the tumor determined. To proceed, the fourth to seventh ribs inclusive are divided and the intercostal vessels ligated. This incision can be modified, but preservation of the ribs gives subsequent support to the thoracic wall. A Balfour abdominal retractor, made so a 17 cm. spread can be obtained, is used and complete exposure obtained. Any adhesions are carefully separated to avoid injury to the lung. The lung is then laid over toward the front part of the mediastinum and kept only partly inflated. Lung retractors are not recommended, as their use is dangerous, and may cause a rupture of the lung from pressure on the inflated organ. If the right pleura is opened, increased intrapulmonic pressure is indicated and lung retractors are then needed. The pleura and connective tissue covering the esophagus are divided over some portion not involved and the esophagus lifted out. A tape thrown around it is used as a retractor. The esophagus is liberated from all structures from the diaphragm to the upper thoracic aperture, except in cases of a high growth where the lower portion need not be freed. Three centimeters are allowed on the lower stump before division for inverting. The dissection is best done by a Kocher goitre sound or by long Mayo dissecting scissors. To avoid the vagi nerves, dissection must be kept close to the esophagus. The nerves must not be picked up with forceps. Their anatomical dissection is necessary only when they are bound to the tumor. The less they are handled the better, but one may be cut if necessary, provided the other is uninjured.

There is great danger of injuring the right pleura in liberating the posterior surface of the middle portion, and care must be used at this point. The dissection of the esophagus where it goes under the left bronchus is done by blunt dissection, using the finger. Great care must be used not to press on the aorta, as it tends to produce cardiac collapse.

The esophagus is freed above the arch. At the upper aperture of the thorax an opening is made by blunt dissection, using the finger. The dissection is carried upward into the neck and out at the anterior

border of the sternomastoid muscle, being completed by sharp dissection under guidance of the finger. A strong silk thread is carried through this incision into the chest, to be used to pull the esophagus out. This method avoids injury to the inferior thyroid artery, one of the sources of blood supply of the esophagus. Three ligatures are then applied, the upper one at a safe distance below the growth. Just below this one the esophagus is crushed with a Payr clamp and a lighter ligature applied. The latter one is invaginated by a purse string, placed 1 to 2 cm. below it. In case the growth is too low to permit sufficient length to invaginate the lower stump, the diaphragm is divided, the stomach is dislodged upward, and the invagination completed. The esophagus is cut between the two upper ligatures and the upper stump cauterized. A second purse string is placed upon the lower stump, if possible, and any diaphragm damage repaired. The end of the upper stump is then pushed under the aorta, and the strong silk thread, previously introduced into the thorax through the neck incisions, is attached to it and the esophagus and growth brought out through the incision in the neck. It is wrapped with gauze and left alone until the thoracic incision is closed. Several pericostal sutures of strong silk are now placed around the seventh and eighth ribs to hold the two ribs together. The ends of the remaining divided ribs assume good alignment. The muscles are closed by layer sutures. The lungs must be inflated before a complete closure of the pleura is made to avoid pneumothorax, though a small amount of air will do no harm. The skin suture is complete. The upper end of the esophagus is then held down in front of the chest, the point of amputation decided, and a transverse incision made through the skin at the site corresponding to this point. This wound is connected with the neck wound by undermining the skin by blunt dissection. The esophagus and growth are drawn down through this channel, the growth amputated, and the free end of the esophagus united to the skin margin by a few interrupted sutures. The most comfortable position for the patient is on the right side and partly on the back. Morphine and stimulants are given as indicated. Camphor, caffeine, digalen, and strophanthus are given for acute cardiac weakness. After the end of the esophagus has healed to the skin wound, one end of a special gastrostomy tube is inserted into the esophageal opening, the lower end into the gastrostomy wound.

Gentle massage in a downward direction over the buried esophagus aids movement of food downward. The patient operated upon is now able to eat practically all kinds of food twenty and a half months after operation.

It will be noted, from the study of Torek's case, that he sutured the pleural cavity without drainage. Sauerbruch also closes the thorax air-tight. Meyer, however, believes that in all cases the thorax should be drained in spite of the good luck attending Torek's operation.

The only additional cases of operation for esophageal cancers that I have noted in the past year were those reported by Bauer,[1] who reported 2 cases, with 1 death from pulmonary embolism a few days later, and the other from suppuration around the perforation in the esophagus; and Borelius,[2] who attempted the operation in 5 cases but found conditions inoperable in all but 2. Neither patient survived, 1 dying from collapse in eighteen hours and the other succumbing soon to pneumonia. He applied the technic reported by Torek.

EXCISION FOR CANCER OF THE LOWER END OF THE ESOPHAGUS. I have previously mentioned that Ach has done a resection of the cardia with apparently a successful operative result. He did this operation without a primary gastrostomy. The abdomen was opened through a left oblique incision and the tumor isolated beneath the diaphragm. Both pleural cavities were opened during the operation and the esophagus was clamped well below the growth. The esophagus was then extracted by means of a special instrument up through the chest and out through the opening in the neck. A Witzel gastrostomy was made in the distal stomach pouch. The method of procedure is illustrated in the accompanying diagrams.

Meyer[3] has operated in the following manner:

A gastrostomy (Witzel) was first performed and at the operation an irregular nodular tumor, the size of a lemon, was felt below the diaphragm. After forced feeding through the gastric fistula with self-masticated food, the radical operation was done four weeks later under endotracheal insufflation anesthesia. An oblique incision parallel to the left border of the ribs and then up in the axillary line was made, carefully avoiding interference with the gastric fistula, and the eleventh and twelfth ribs resected. The place for the division of the stomach below the growth was selected, and after the usual ligations the tumor in the esophagus was loosened. The stomach was then divided, and the opening closed by means of Hueltl's wire-stitching instrument, a good-sized pouch being left in connection with the gastric fistula. The esophagus was then clamped and ligated above the growth, and the growth and the stump sterilized with carbolic acid and alcohol. It was found, on pulling the mass downward, that the thoracic portion of the esophagus descended only a trifle, although all adhesions around the cardia had been severed as much as possible. Patient was then turned entirely on the right side and a left thoracotomy in the seventh interspace performed, the opening being enlarged by means of the rib-spreader. The mediastinal pleura was incised to the right of the descending aorta and the esophageal stump immediately found and thoroughly

[1] Nordisches med. Archiv, February 27, 1915. Abstracted in Journal of the American Medical Association, 1915, lxiv, 1803.

[2] Hygiea, 1915, lxvii, abstracted in Journal of the American Medical Association, 1915, lxiv, 952.

[3] Annals of Surgery, 1915, lxii, 699.

FIG. 14.—Fifth case of resection of the cardia for carcinoma; operative recovery. The blackened part in the diagram represents extent of tumor. Excision done from abdomen; extraction of proximal stump of divided esophagus by special method; gastrostomy added. Patient died.



FIG. 13.—Meyer's esophageal extractor. A, ready for introduction: the perforated bullet is drawn up toward the sound's mushroom tip, which has a rounded border. B, the bullet is milked down until it approaches the ligated stump of the proximal end.
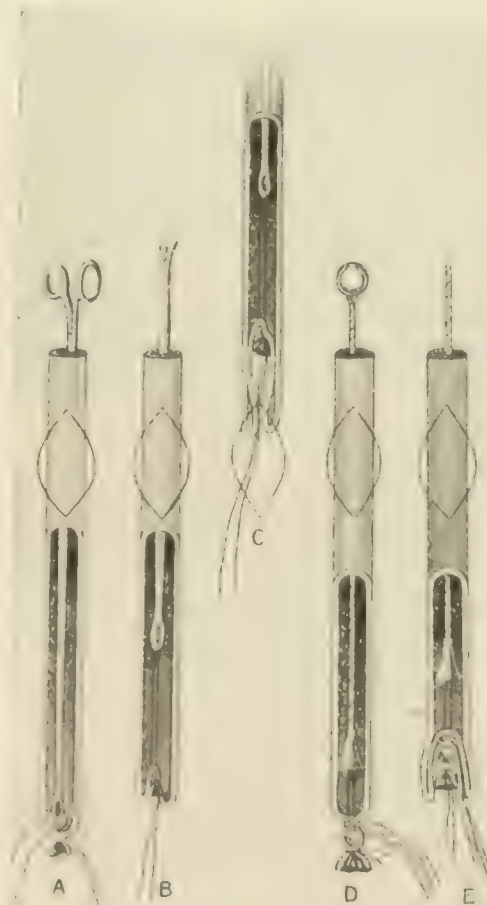
FIG. 15.—Diagrammatic: Showing esophagus stump in course of extraction. A, B, and C being done with Ach's wire extractor; D and E demonstrating the procedure with extractor. In D and E the silk threads are shown to pierce the wall of the esophagus, the lower end of which harbors the perforated shot.

freed, a difficult and time-consuming procedure. The esophagus was then pulled up and out through the usual wounds in the neck and placed under an antithoracic skin bridge and stitched in a transverse wound just above the third costal cartilage. The wounds in the neck, thorax, and abdomen were then closed, and the pleural cavity drained through an incision in the ninth interspace. The patient died fifteen hours after operation, probably from shock.

In a second case Meyer introduced a wire loop to draw the esophagus up to the neck and states that the procedure impressed him as a useful, gentle, and ingenious method of transposing the oral stump of the esophagus. Unfortunately, this patient died on the table.

Meyer has modified the instrument of Ach, as shown in the illustration.

Finally, Meyer[1] suggests the following problems for solution: Is primary gastrostomy as the first stage absolutely necessary? Could the gastric fistula not be established after the excision of the tumor at the same sitting, *viz.*, the entire work done at one stage? Is primary double division of the pneumogastrics within the thorax or at the cardia really the cause of leakage of the gastric fistula, as observed by Ach and by Meyer? Can we get sufficient access to the vault of the diaphragm without an additional bone operation in the presence of a gastric fistula? How long may the transposed proximal stump of the esophagus be without becoming necrotic? By what means can we prevent necrosis at the distal end? Should, for the purpose of extraction, the nervi vagi better be dissected off the esophageal wall and left intact, like guides on either side of the tube? It is plausible that in the presence of firm adhesions alongside the esophagus one of the nerves might be torn out if divided near the cardia before the extraction. In view of the fact that excision of the malignant tumor is the main object of the work, is it wise or permissible to make it the third stage of the operation?

RADIUM IN ESOPHAGEAL CANCER. Meyer[2] suggests that a certain percentage of early cases of carcinoma of the esophagus or cardia could be benefited by treatment with radium because many of them are of the squamous-cell type which corresponds to the epithelioma of the skin. He seems skeptical, however, of a radical cure, and believes that by so attempting the best time for operation will be lost.

Lewin[3] states that he has treated 25 cases, and, with the exception of a few that were hopeless from the beginning, he has had more or less favorable results. In 1 case the cancer, insofar as the clinical appearance went, was completely cured after five months.

[1] Annals of Surgery, 1915, lxii, 708.
[2] Ibid., lxii, 707.
[3] Therap. d. Gegenew., 1914, iv, 103.

# INFECTIOUS DISEASES, INCLUDING ACUTE RHEUMATISM, CROUPOUS PNEUMONIA, AND INFLUENZA.

## By JOHN RUHRÄH, M.D.

In spite of the great conflict going on in Europe, the contributions in the past year in the field of infectious diseases has been nearly normal. This may, perhaps, be due to the publication of work completed before the war began. The Spanish and Italian journals have, for the most part, been coming very much as usual, and the few French publications, as well as the English, have also arrived with reasonable regularity. The German journals have been seriously interfered with as far as many libraries are concerned, and my source of supply is among those affected, so that I have been unable to consult, in the more recent numbers, some of the articles which should be included in this report. Whatever omissions there may be of importance, I shall endeavor to include in next year's review.

There have not been as many contributions of extraordinary importance as in some of the previous years, and yet there have been numerous studies made that are well worthy of careful study, and a few announcements have been made of discoveries that will become historic. Most prominent of these is perhaps the article of Plotz, Olitzky, and Baehr on the discovery of the bacillus of typhus fever and the beginning of important researches upon serological studies in connection with it. The presence of the disease in certain parts of Europe ought to afford an opportunity of utilizing their discovery. Next to this comes the announcement of Noguchi of his success in growing vaccine virus and so producing a perfectly sterile material for use in human beings. As far as I know, this has not yet been put upon the market, but I have seen some of the vaccinations done with it which seemed to be highly satisfactory, and, if the observations now being made regarding its use are in accord with what is to be expected, this method of producing vaccine virus will undoubtedly make its way into practical use. The method of making a laboratory diagnosis of smallpox, as suggested by Force and Beckwith, will be hailed with delight by diagnosticians of health departments as it will aid them in checking up their opinions concerning doubtful cases. Another suggestion worthy of careful consideration, even if one is not impressed with it at first glance, is that of Petruschky who has conducted some remarkable experiments

in immunizing individuals from tuberculosis and also in treating certain cases of the disease by means of the percutaneous method. His suggestion is not limited to tuberculosis but he has also made some observation on other bacterial diseases. Typhoid fever has come in for a large amount of space, most of the contributions dealing with therapeutic investigations including a suggestion of autogenous therapy. The question of the use of mixed vaccines, including the paratyphoid bacilli, has also been considered by several authorities. Further studies have also been made in the use of emetine in the various amebic infections, and sprue and balantidiosis have been added to the diseases which are in the range of its effective action. Pellagra has also continued to be studied as regards its etiology, and these more recent contributions seem to class the disease as a nutritional disturbance due to the lessened animal food and the increased use of certain forms of carbohydrates. Whether or not there is the added element of infection has not been definitely decided. It would seem to come in the class of diseases that includes rickets, scurvy, and beri-beri. Important contributions have been made by Strong and his co-workers on oroya fever, and also on the virus of verruca peruviana. The Schick reaction has been studied by numerous observers and its place in medical practice can be more clearly defined, although much remains to be discovered concerning it and similar tests. The use of blood of convalescents in the protective therapy of various diseases has attracted the attention of an increasing number of observers, and contributions have been made on this, especially in cerebrospinal fever, scarlet fever, and mumps. A contribution to which I would like to call particular attention is on the subject of meningitis, and is made by du Bois and Neal. This article, while it does not contain any new ideas, is a presentation of the most important points of the diagnosis of the disease based on their own observations, and presenting the subject just as one who has to practice medicine wishes to have it. I have seen few contributions in recent years that are as illuminating, particularly for one who has to deal with the question of diagnosis and who is, perhaps, not entirely schooled in the interpretation of the laboratory findings.

**Infectious Diseases in the United States** The prevalence of infectious diseases in the United States is followed by the Public Health Service, and every year the number of States furnishing reports is increasing, but there are still some States in which the methods of collecting data on the communicable diseases are too primitive to be of any service. Twenty-seven States, however, are taking sufficient interest in the subject to make reports of value, and, in addition to this, the reports are received from the District of Columbia, Hawaii, Philippine Islands, and Porto Rico. The activity of a health department may be judged largely by the high case-rate, especially when this is accompanied by a relatively small number of deaths and indicated by a low fatality-rate.

Until the State reports are more complete, one must read between the lines of the figures in order to get at the true state of affairs. When there is a high case-rate, it usually means that the cases are being properly reported and it does not necessarily mean that the disease is more prevalent in that State than in others. A high fatality-rate may mean that a disease was unusually virulent or that the physicians did not treat the disease with the success obtained elsewhere, or that the practising physicians did not report all of their cases. On the other hand, an unusually low fatality case-rate may be due to the fact that the disease in that State was unusually mild, that the physicians treated it with unusual success, that the practicing physicians reported their cases satisfactorily, or that the registration of deaths was incomplete, or the assignment of the causes of death inaccurate.

Mississippi has the highest reported case-rate for *measles*, and Utah one of the highest case-rates for *scarlet fever*. As regards *typhoid fever*, the highest case-rates were from Mississippi, Virginia, and Utah. Next to Mississippi, *tuberculosis* was reported in the greatest proportion of cases and deaths from Maryland. The figures from Mississippi do not mean that the cases are being reported very much better in that State, but it may be that there is some duplication which might easily occur, particularly in such diseases as tuberculosis which run for a long period of time. Five States give figures as to the prevalence of *gonorrhea*, but the total number of cases reported shows that at present these figures are of no value whatever. For example, in the State of Kansas, during the entire year of 1914, 5 cases were reported, 4 of which died. In the State of Michigan, 21 cases were reported and no deaths. This shows that the reporting of cases of venereal diseases to the Health Department, however desirable, is, in the present state of the public mind, impracticable, and it will require further education to make the figures of any value. *Syphilis* is reported in four States and in Porto Rico. California reported 310 cases, with 223 deaths, the other States reported comparatively few except Vermont, with 212 cases and 7 deaths. The number of *lepers* reported during 1914 for the United States itself is rather small. Hawaii reports 60, the Philippine Islands, 596; Porto Rico, 9; California, 7; District of Columbia, 2; South Carolina and Wisconsin, each 1. I can only reiterate what I said last year regarding the national care and control of lepers. The National Government should provide a suitable colony where these unfortunates can live without spreading the disease to others, while the closed cases could be allowed to go about with a certain amount of supervision. It is to be hoped that the public and physicians will eventually become impressed with the importance of reporting promptly cases of communicable disease under their care, and it is only by this means that the prevalence of these diseases be accurately determined and steps be taken to eradicate them.

**Intestinal Infection with Animal Parasites.** Stiles[1] has made a study of the animal parasites among the school children in a city, which he does not name, in one of the gulf Atlantic States. This town has a population of about thirty thousand inhabitants, among whom the whites outnumber the negroes. Part of the homes have sewer connection. Part of them have either surface, or can, privies.

Examination was made of 1287 school-children, of whom 776 were white and 511 negroes. The parasites found may be classified in two larger biological groups from the standpoint and method of infection. Certain protozoa, such as the endameba, lamblia, trichomonas, the ascaris, the oxyurus, and the trichiuris or whipworm are contracted by swallowing the germs contained in human excrement and in no other way. The germs may be spread by flies, dogs, chickens, and other small animals, and finally reach the mouth through infected food, water, soiled fingers, or by putting into the mouth other objects soiled by the scattered excreta. The hookworm infection can be contracted through the skin as well as by mouth, and infection with the dwarf tapeworm (Hymenolepis nana) is probably contracted only through the mouth, but it is still an open question whether this is through swallowing human excrement containing eggs or by swallowing the insect that acts as an intermediate host. Of the total 776 children examined, 218, or 28.09 per cent., surely obtained infections by swallowing human excrement, and this is due to the fact that in the surroundings in which the school-children have been living or by which their lives are influenced, human excrement has not been disposed of in a safe and proper manner but has been permitted to come in contact with their bodies and with their food and drink.

The children were studied with reference to whether they live in sewered homes or not, and, with the exception of the Endameba coli and the oxyuris, the infection was greater in the children who lived in unsewered homes. There were only 2 children who showed infection with the dwarf tapeworm and both of these lived in sewered homes. A curious fact came out in the examination, that 83, or 10.69 per cent., showed infection of hookworms. This is a higher percentage in city school-children than shown in some of the clay land counties. In a great many of the children, double infections were found, and, in 3, triple infections. There was a somewhat greater number of negroes infected than white children but this was to be expected, both from the manner of life and from the greater difficulty in securing proper sanitary surroundings.

The conclusions drawn from the study are that there is a large amount of coprophagia occurring in human beings. This varies to a considerable extent even in the same town, being less among people living in homes

provided with sewers, but the variation is not mathematically proportionate to the number of sewer connections. Part of the difference is due to the fact that the flies carry the filth to the food, and part to the infection due to soiled persons who prepare the food, and it is impossible to estimate the ratios of these two sources. The whole study shows a great need for the proper disposal of the excreta, a feature of American life which is greatly neglected, particularly in the rural districts of the South.

In a second study, Stiles[1] has considered the children examined from the standpoint of the progress made in school. If the children are divided into sanitary groups according to the presence of a sewer connection or a privy at their homes, it is clear that the children who have sewered homes advance more quickly than the children who have homes provided with a privy. The boys from sewered homes advance more rapidly than do average girls, and more rapidly than girls from homes provided with a privy. Thus, home sanitation is an index to two distinct groups of school children. There are a great many different things that would have to be considered in explaining this fact, and it must not be assumed that the presence or absence of a sewer is the only factor in the case. Stiles says, however, that it is legitimate to invite attention to the fact that more cases of soil-pollution diseases are to be expected at privy homes than at sewered homes, and therefore that more absence from school, with consequent retardation caused by these diseases, is to be expected from children among privy homes than among those from sewered homes. The conclusion therefore seems to be justified that the privy with its dangers of disease is one of the many factors involved in explaining the data submitted. If the cases are studied with reference to the kind of parasite found, it is seen that the Endameba coli and the lamblia apparently do not cause any retardation. The statistics of the infection with the Ascaris lumbricoides and with Necator americanus tend to support the view that these two parasites are factors and must be considered as of practical importance in connection with retardation even in cases of relatively light infection. The effect produced by the ascaris is less than that produced by the hookworm. The data for infection with the trichomonas, oxyuris, trichiuris, and Hymenolepis nana are not sufficient to warrant any deductions as respects these parasites.

Stiles and Wheeler,[2] have also studied the heights and weights of these school-children for the purpose of obtaining statistics on this subject that were based on observations made in the South. At the same time he compared the weights of the children suffering with intestinal parasites and found that the Ascaris endameba coli and lamblia apparently did not act detrimentally upon the weights of the children. The cases

[1] Public Health Reports, July 9, 1915, p. 2060.
[2] Ibid., October 8, 1915, p. 2990.

of hookworm infection encountered were light, but even these infections seem to have an appreciable effect upon the height and weight of the children, inasmuch as the greater proportion of them were below the average height and also below the average weight.

**The Use of Dahlia in Infections.**   The anilin dyes have been known to exert certain antiseptic actions and this has been the subject of a considerable amount of study.   As early as 1886, Pfeffer showed the effects of certain anilin dyes upon the cells of the higher plants, and in the following year Rozsahegyi pointed out the harmful action upon certain bacteria.   It seems that the curative action of anilin upon wounds has been known to workers in the dye factories where it is the custom to treat skin wounds by dusting them with various dyes, and Kramenski suggested the use of pure anilin and of anilin dyes as inhalations in the treatment of tuberculosis of the lungs.   Various observers, among whom may be mentioned Churchman and Simon and Wood, have studied the bactericidal properties of the anilin dyes and have found that the acid dyes, irrespective of color, are not toxic for bacteria, while the basic dyes, without reference to the color, possess a remarkable inhibitory power even in the most dilute solutions.

In searching for an efficient local application for streptococcic infections of the throat, Dr. Charles Simon suggested the use of dahlia, and I[1] have made a short report of the use of this dye, not only in throat infections but on other infections of the mucous membrane and of the skin. It may be applied in the saturation solution, that is, about 4 per cent., without producing either pain or subsequent irritation.   It only penetrates to a short distance, therefore for the deeper-seated infections it has no value, but when the inflammation is on the surface the effect is quite striking.   In the cases in which there is ulceration, the dahlia not only kills the offending organism but has a most stimulating effect upon the healing.   One application a day of the saturated solution is generally sufficient, but weaker solutions, varying in strength from 1 to 1000 and from 1 to 10,000, may be used as a mouth wash or as irrigation.

I have not had an opportunity to use it in erysipelas, but Dr. Louis P. Hamburger and Dr. T. B. Johnson, of Frederick, have used it with the most satisfactory results.   It is of considerable value in the various forms of tinea, and may be used with reasonable hope of success in skin lesions caused by, or accompanied with, pus organisms.   It may also be used in ointments, and for this purpose the weaker ointments are to be chosen, 1 per cent. ordinarily being sufficient to obtain results.

**The Streptococcus Viridans in its Relation to Infections of the Upper Respiratory Tract.**   Ever since the beginning of bacteriological studies, a very considerable amount of interest has centred around the strepto-

[1] The American Journal of the Medical Sciences, May, 1915, p. 661.

cocci, the difficulty always having been that there was no suitable basis for a classification. The previous efforts were largely based on attempts to differentiate them by means of the carbohydrate fermentation test. In 1903 Schottmueller suggested a classification based on the appearance of the colonies as grown on blood agar, and this classification has been largely used by recent writers. He divides them into three groups: (1) Streptococcus hemolyticus, which causes hemolysis about the colony when grown on blood agar, and morphologically it appears in chains of slightly oval cocci. This is found almost constantly in erysipelas, the complications of scarlet fever, and is associated with suppurative and phlegmonous inflammations. (2) The Streptococcus viridans, which grows as a small gray colony surrounded by a green zone, and in smears these are seen in pairs resembling pneumococci, or in short and long chains arranged in pairs. This is usually without a capsule, and is found associated with inflammations of endothelial and mucous surfaces, and is a frequent cause of mild catarrhal inflammations. (3) The Streptococcus mucosus, the colonies of which on blood agar look like small drops of mucous. These are chains of diplococci with a thick capsule, and there is no indentation between the pairs.

Cecil[1] has made a study of the incidence of the Streptococcus viridans in infections of the various parts of the upper air passages, and also the relation which this organism has to arthritis, endocarditis, and other systemic disorders. His study, as published, is based on 89 cases, although many more than these have been observed.

There is some difference of opinion regarding the nature of the Streptococcus viridans, and some have believed that it is merely an attenuated form of the pneumococcus. Rosenow, as was noted in PROGRESSIVE MEDICINE last year, has succeeded in transmuting streptococci into pneumococci, and *vice versa*. The Streptococcus viridans is not very virulent in animals, and only rarely produces fatal results in human beings, and of all the organisms in the streptococcus-pneumococcus group, it may be regarded as the least harmful, as at times it seems to be able to live in the body without producing any reaction at all, and this is particularly true of those found in the mouth. The experimental evidence as to the effects on animals varies somewhat, and some observers have not been able to produce arthritis, or only rarely so, while Rosenow, using an organism closely resembling the viridans, was able to produce endocarditis in nearly every instance. We are so accustomed to think of the Streptococcus viridans as being almost exclusively associated with chronic infectious endocarditis, that we have forgot that a large number of the inflammatory lesions of the upper air passages are due to this organism. All three forms of the streptococci, and also pneumococcus, may usually be found in the mouths of healthy individuals,

[1] The Archives of Internal Medicine, January 15, 1915, p. 150.

but the viridans is generally the most abundant. Most of the previous observations have not separated very definitely the type of organism found, but Schottmueller found the viridans in tonsillitis, conjunctivitis, acute and chronic rhinitis, otitis media, empyema, pericarditis, lung abscess, endocarditis, acute enteritis, and other abdominal inflammatory diseases.

Camac, Billings, and others, in their studies on the relation of oral sepsis to chronic arthritis, have called attention to this organism as a cause of disease, and Rosenow has fully demonstrated that either this, or very closely related organism, play a most important part in the inflammations of the serous surfaces.

In the 89 cases studied by Cecil, 50, or 56.2 per cent., have shown a predominance of the Streptococcus viridans on blood agar plants. Inasmuch as these organisms are not grown with great ease, the predominance would seem to indicate that they played an important part in the lesion from which they were cultivated. Next in frequency was found the pneumococcus, and, including with those the Streptococcus mucosus, there were 20.2 per cent. of cases, while 6.7 per cent. showed the predominance of the Streptococcus hemolyticus. The remaining 17 per cent. was divided between the bacillus of influenza, the Micrococcus catarrhalis, Friedländer's bacillus, Bacillus septus, Staphylococcus aureus, Micrococcus paratetragenus, and the Staphylococcus albus and citreus. The same form of staphylococcus was encountered in almost every case, but only in a few instances was it predominant, and it would seem that they play a very insignificant part in the infections of the upper air passages.

In infections of the tonsils, the streptococcus is by far the commonest organism present. The type of streptococcus has not been reported on in very many instances. Cecil found the Streptococcus viridans predominant in 16 out of 23 cases. Streit, on the other hand, has reported the Streptococcus hemolyticus in 49 out of 56 cases of tonsillitis and peritonsillar abscess. Davis, studying the bacteria in excised tonsils, and taken chiefly from cases of arthritis, heart disease, and chronic nephritis, found the Streptococcus hemolyticus in a large percentage of cases. His cultures were made from the deep part of the tonsillar crypts, while Cecil's cultures were made from the tonsil in the bed, taking the culture from as deep as possible, but, of course, always much more superficially than could have been done if the tonsil had been excised. In acute cases, the Streptococcus viridans may be frequently found in mild ones, the hemolyticus in cases associated with scarlet fever and with peritonsillar abscess, while in some instances pure cultures of the pneumococcus have been obtained. The relation between the organisms in the clinical pictures of the disease is certainly not such that one can tell which type of organism is present without a culture.

In rheumatism, Poynton and Payne have isolated an organism from

the joint, which they called Streptococcus rheumaticus. It is not clear whether this organism is a very close relation to the Streptococcus viridans or not, but Rosenow found an organism in the joints of rheumatic cases, which after cultivation came to resemble the Streptococcus viridans. Cecil studied the cultures from the crypts of the tonsils in 5 cases of acute rheumatic fever, and found the Streptococcus viridans in all, and in 1 case in pure culture. Unfortunately, he did not make any study of the joints. In 2 very typical cases of subacute infectious endocarditis, with no external evidence of disease in the tonsil, cultures showed the Streptococcus viridans. In both cases there was a history of recent colds. In 3 instances of chronic arthritis, associated with chronic tonsillitis, he also found the Streptococcus viridans in all cases. The association of joint troubles with pyorrhea alveolaris led to a study of the bacteriology of this disease, and in 15 cases studied there was an abundant growth of Streptococcus viridans in each instance. This corresponds somewhat to the findings of Goadby, who, in 90 cases, found the streptococcus in 55, and the staphylococcus in 63.

The Bacillus fusiformis and various kinds of spirochetes have also been demonstrated more recently, and in many cases the endameba, but the streptococcus is probably the cause of the associated joint troubles. In 2 instances of pyorrhea associated with nephritis the Streptococcus viridans was also found to be the predominant organism.

In acute coryza, the organisms which have ordinarily been described are the Bacillus septis, the pneumococcus, the Micrococcus catarrhalis, and diphtheroid bacillus.

The Streptococcus viridans is also frequently to be found almost in pure culture in both acute and chronic rhinitis. This organism is frequently the cause of infection of the accessory sinuses. Studies from these cases have given rather variable results. The healthy sinuses are practically always free from bacteria. Numerous observers have found the streptococcus, type not given, and the pneumococcus is also rather a frequent cause. Allen, in 30 cases, found the Bacillus influenza in 73 per cent., but in these cases the streptococcus or pneumococcus, or both, were present in 80 per cent. of the cases as well. Cecil studied 8 cases of sinus infection, and in 3 the Streptococcus viridans was the predominant organism.

In infections of middle ear, this organism is usually not encountered, although it occasionally may be the cause of the inflammation.

The bacteriology of bronchitis very frequently shows the presence of a streptococcus, sometimes the influenza bacillus is present, sometimes the pneumococcus, sometimes the Staphylococcus aureus and the Micrococcus catarrhalis. Holt, in 354 cases in children, found the pneumococcus in 231, streptococcus in 109, and Staphylococcus aureus in 266. The type of streptococcus is not stated. Cecil found the organism in 3 out of 4 cases of acute bronchitis which he

studied, and all these cases were mild. He also studied 6 chronic cases, 4 of which showed the predominance of the Streptococcus viridans, and all of these had a more or less well-defined asthma.

Cecil believes that the best form of treatment is the use of autogenous vaccine, and that it is of value in the prevention of the recurrence of these infections. In cases in which the structural changes are very far advanced, not much is to be looked for from the use of vaccines.

**Kaolin in the Treatment of Bacteria Carriers.** The subject was reviewed in PROGRESSIVE MEDICINE, December, 1915, p. 375.

**Percutaneous Immunization.** A new method of producing immunity and of treating bacterial diseases has been suggested by Petruschky.[1] His first work was conducted with tuberculosis, and those interested in the exact details will do well to consult the original article.[2] A somewhat similar plan of treatment was suggested by von Kutschera in the same year. The original problem taken up by Petruschky was the freeing of the peninsula of Hela of tuberculosis. On this peninsula there are about five hundred people, and a systematic effort was made to root out the disease. In addition to isolating a few severe cases of the disease, all the others were treated by inunction of an ointment of dead tubercle bacilli. These bacilli are absorbed through the skin within twenty-four hours and are taken up in the body, and this happens without any distinct changes in the skin. The ointment has been prepared in three strengths, the strongest of which has not yet been used, but which is made in case any especially resistant cases are encountered. The healing took place in 95 per cent. of the cases and included circumscribed tuberculous lesions and the so-called latent forms, as well as cases in which the lymph nodes were involved. In order to secure these results it is necessary to use the ointment systematically and over a long period of time. Since 1911 there have been no cases of "open" tuberculosis, and, of the 4 seen at the beginning of the work, 1 was cured in a sanitarium in connection with the inunction treatment and the other 3 have since died. The suggestion is also made that this method may be used in children who were not infected but whose parents are tuberculous. Petruschky has some experiments covering this point now under way. He has also attempted to treat the complications caused by various bacteria by this method, chiefly those due to the pneumococcus, Diplococcus catarrhalis, streptococcus, and staphylococcus. He claims to obtain extraordinarily good results from the combination of some of these. The greatest difficulty has been in connection with the influenza bacillus which grows so feebly that it is difficult to obtain a sufficient amount to be used for purposes of vaccination. He has also had very good results in chronic streptococcus infections, and he believes that the resistance to the ordinary organisms may be greatly increased

[1] Medizinische Wochenschrift, February 2, 1915, p. 145.
[2] Wiener klinische Wochenschrift, 1913, No. 26.

by using this method. He has also considered the problem as applied to some other diseases, particularly the great military plagues of dysentery, typhoid, and cholera. The cholera and typhoid vaccines may at present be given satisfactorily by subcutaneous injection, but it is not possible to use injections in cases of dysentery owing to the toxity of the dysentery bacillus and the pains following the subcutaneous inoculations. He has made a combination of the dysentery bacillus of Kruse, the bacillus of Flexner, and the paratyphoid A and B; from experiments upon himself he has demonstrated that this can be used without any untoward symptoms, and may be applied in inunctions at intervals of one or two days. At present he has no extensive series of observations to report, so that one cannot judge of its effectiveness. These observations suggest the work of von Wassermann on local skin immunization with his histopin and histopin salve. This question of percutaneous immunization is worthy of careful consideration and should not be dismissed on account of its novelty or simplicity. If Pertruschky's observations are confirmed, it will mean a direct advance in a most perplexing and difficult problem.

**The Colon Bacillus and Pasteurization of Milk.** Ayres and Johnson[1] have made some observations on the subject of the ability of the colon bacillus to withstand heat. Their observations have a direct bearing upon the subject of the pasteurization of milk. As ordinarily carried out, milk is heated to from 60° to 63° C. (140° to 145.4° F.) and kept at this temperature for from twenty to thirty minutes. Higher temperatures are liable to produce changes in the milk, either direct chemical change or destruction of too many of the lactic acid bacilli, so that the milk may subsequently spoil by what is known as alkaline fermentation without becoming sour from the growth of the lactic acid bacillus, as would occur normally. It is ordinarily assumed that if pasteurized milk shows the presence of the colon bacillus, it has either not been sufficiently heated or it has been infected by careless handling after pasteurization. According to most observations, the colon bacillus has a low thermal death-point. Ayres and Johnson studied cultures which were isolated from various sources and these were heated at various temperatures for thirty minutes. At 60° C. (140° F.), the lowest temperature used, 95 out of 170 pure cultures, or 54.29 per cent., were not destroyed. At 62.8° C. (145° F.) only 12, or 6.89 per cent., survived. In one instance the organism was not destroyed at 65.6° C. (150° F.), but subsequent experiments with the same culture at this temperature always killed it.

These observations probably make clear the differences so often observed in commercial pasteurization. If a difference of 2.8° C. (5° F.) can make a difference of nearly 90 per cent. of the bacteria killed, it

is very easy to see that slight variations, which may easily occur when the process is not carefully superintended, may result in milk which is not free from danger. It will be noted that with pasteurization at 62.8° C. (145° F.) a certain proportion of colon bacilli are apt to survive, so that, using them as a test, it does not seem to be a rational thing unless the pasteurization is done at a degree of temperature sufficient to kill all of the colon bacilli, which would be 65.6° C. (150° F.) for all except an occasional strain of colon bacillus which might resist greater temperatures.

**The Bacillus Abortus in Human Beings.** For many years it has been common knowledge to dealers in cattle and dairy men that the disease known as contagious abortion was infectious, and caused a severe economic loss to animal owners. Bang, of Copenhagen, in 1896. isolated the organism which is now recognized as the cause of the disease. Bang shows that this bacillus was not only infective for cattle, but also attacked domestic and laboratory animals. In the domestic animals, the site of infection seems to be the uterine mucosa of pregnant animals. More recently, Smith, Fabyean, Schroeder, and Cotton have shown that this is not the only site of infection, but that if guinea-pigs are inoculated intraperitoneally a condition is caused which cannot be differentiated macroscopically from tuberculosis. The spleen, the lymphatic system, the bones, liver, and kidneys are also extensively involved. Laboratory animals infected with the disease do not always abort. The disease is very wide-spread among cattle, and the Bureau of Animal Industry has shown that a very large percentage of market milk contains the bacillus.

Sedgwick and Larson,[1] have made a second report on the subject of the complement-fixation as occurring in children when the bacillus abortus is used as an antigen. In their first report they tested a series of 425 children with either the agglutination or complement-fixation reactions, or both, and found that 17 per cent. gave a positive reaction. In certain groups of children the percentage was higher, sometimes over 40 per cent., and in one group in an institution positive reactions were found in as high as 48 per cent. They subsequently determined that newborn children who had been fed at the breast do not show a reaction. In one instance a baby three weeks old, after having been fed at the breast for two weeks and on a food containing cow's milk, gave a positive reaction. They studied a large number of diseased conditions, none of which gave positive reactions, and they have also determined that children giving positive Wassermann reactions may show a negative reaction when the Bacillus abortus is used as an antigen. Whether the bacillus actually infects the blood or whether the reaction is the result of antibody absorption through the digestive tract

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[1] American Journal of Diseases of Children, September, 1915, p. 197.

cannot at present be definitely decided. The fact that positive reactions were found in children with large spleens is, however, very suggestive.

Nicoll and Pratt[1] have reported an instance occurring in an obstetric ward in which a woman giving a negative Wassermann reaction miscarried at the seventh month. The serum of the mother reacted up to 1 to 300 with a Bacillus abortus, but later became less active and at the end of five months reacted at only 1 to 100. The serum of the child gave about the same reaction on one test. Efforts to isolate the organism from the discharges of mother and child were completely negative. Up to the present time there is no definite evidence that this bacillus produces lesions in human beings, although the subject is well worth further study. There has been one instance in which the organism was isolated from the tonsil. As this may have come from the milk, it cannot be regarded as any evidence of a disease process.

**Splenic Anemia.** Since the discovery of an organism in Hodgkin's disease, there has been considerable activity in searching for diphtheroid bacilli in other diseases, and Yates, Bunting, and Kristjansen[2] have described a bacillus obtained in pure cultures from two spleens removed surgically in the treatment of splenic anemia. Histological studies of the two spleens confirmed the clinical diagnosis of splenic anemia, or what the authors call the early stage of Banti's disease. The organism found is very similar to the bacillus previously described in Hodgkin's disease by the same investigators. Inoculations into dogs and rabbits produced changes which were regarded as characteristic of splenic anemia.

Early in 1914 Gibbons[3] found, in stained sections in 6 cases of enlarged spleen, an organism which was at times segmented, and at times found in bacillary form. He was inclined to regard the organism as a streptothrix. Yates and his associates believe that there is a close relation between splenic anemia and Hodgkin's disease, and think it is possible that they are only variations in manifestation of a single type of infection.

**Amebic Infections.** Of recent years a considerable amount of attention has been paid to the various forms of amebas. These have recently been divided into a number of different genera. Calkins suggests for the present to group them as Ameba Vahlkampfia, Craigia, Trismastigameba, and Parameba. In former years the amebas were looked upon as harmless parasites, but subsequently they were regarded with more or less suspicion, and now the opinion is that some of them are harmless and that some are capable of producing disease and some seem to be unable to exert any harmful influence until symbiotic bacteria appear in the intestine. The Endameba histolytica, of course, is capable of causing amebic dysentery. The Craigia hominis, named after Captain

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[1] American Journal of Diseases of Children, September, 1915, p. 203.

[2] Journal of American Medical Association, December 19, 1914, p. 2225.

[3] Quarterly Journal of Medicine, January, 1914, p. 153.

Craig who first described it as occurring in cases of chronic dysentery, has been recently studied by Barlow,[1] in Honduras. He found this parasite in numerous cases of a disease presenting the symptoms of mild dysentery or chronic diarrhea. Barlow believes that the individuals who have been infected may be general carriers for a long period of time. The most satisfactory treatment has been the administration of emetin hypodermically, or ipecac internally.

MODE OF ACTION OF EMETIN IN AMEBIC INFECTIONS. An article of some interest on this subject has been contributed by Lyons.[2] The point which he brings out includes the fact that when either ipecac or emetin are taken by the mouth or the latter subcutaneously, they act through the absorption into the blood stream and exert their specific effect only on those endamebas within reach of the circulation, that is, the ones within the tissues. Those that are found in the lumen of the bowel are unaffected according to his observations, either by the oral or subcutaneous use of emetin or ipecac. The emetin does not seem to be eliminated through the intestinal tract, inasmuch as it does not kill the parasites that are there. The relapses he believes are due to the survival of some of the parasites on account of their having become encysted, and this takes place in the tissues of the intestine. The ameba carriers apparently harbor the parasites in the intestine without their attacking the individual or producing any symptoms, but nothing is known at the present time of the manner of defence of the body against infection by the organism in these carrier cases. Lyons believes that the best effects are obtained by the subcutaneous administration of emetin, and small and repeated injections are to be preferred as they are more rapidly absorbed and the therapeutic effect of the drug is better maintained. In the severest cases he suggests that it be given intravenously, in the average case one grain a day, or less, is sufficient, and the treatment should be continued from one to two weeks. In order to prevent relapses, the treatment may be repeated or the intermittent method may be used. Care should be taken not to administer too large doses or to continue the treatment too long.

URINARY AMEBIASIS. This is a rare condition which has been described a few times, one of the earliest cases being that of Baelz, which occurred in a woman in Japan. The endamebæ were found both in the bladder and in the vagina, and Baelz was of the opinion that the parasites were introduced with water used for washing. Baelz's paper was published in 1883, twenty years before Schaudinn pointed out the distinctive characteristics of the pathogenic and non-pathogenic endamebæ. Walton[3] has reported an instance which occurred in Lucknow in a Brahman, aged eighteen years, who was engaged in agricultural pur-

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[1] American Journal of Preventive Diseases and Tropical Medicine, 1915, p. 680.
[2] American Journal of the Medical Sciences, July, 1915, p. 108.
[3] British Medical Journal, May 15, 1915, p. 844.

suits. The patient had suffered from hematuria for six months, and from anasarca in the legs, penis and scrotum for about three weeks, and had a very small superficial ulcer near the meatus. There was no tenderness or irritability of the bladder and the stools were free from endamebæ. The urine was rather scanty and deeply blood-stained, acid in reaction and contained much albumin, numerous pus cells, red-blood cells, and a considerable number of hyaline and granular tube casts. It also contained very numerous actively motile endamebæ. He was given half-grain doses of emetin hydrochloride twice a day and the following day the amebæ were very numerous and very motile. In forty-eight hours, by which time the patient had received two and one-half grains of emetin, the amebæ were much diminished in numbers and decidedly more sluggish; the following morning the urine was much clearer and no active organisms could be seen. The other symptoms disappeared but he was apparently left with a chronic nephritis, the urine containing a small quantity of albumin with an occasional tube cast. There has been no reappearance of the endamebæ in the urine.

The ameba was studied by the usual methods and it is believed that it was the Endamæbæ tetragena. Braun, in his work on *Animal Parasites of Man*, published in 1906, refers to 9 cases in the literature. Previous to the treatment with emetin the cases were chronic and had a great tendency to relapse.

**Ascaris in the Tonsil.** The ascaris frequently does the most extraordinary things. Middleton[1] has contributed a remarkable occurrence.

The patient was a girl, aged eight years, who did well until two years of age, but following an attack of chicken-pox at that time, had not been in good health. She was pale, anemic, undersized, with an adenoid expression, and subject to frequent bilious spells, which recurred about every three weeks. Both tonsils were found to be enlarged, the right paler than the left. At the operation, as the snare wire which was used was tightened, the tonsil ruptured, and some whitish object presented itself, which was first thought to be the contents of an abscess cavity or a crypt full of retained secretions. This proved, however, to be a roundworm, a female of the Ascaris lumbricoides. The worm was about an inch and a quarter long. Since the removal of the tonsils the child has regained its health, and is improving in every way. In this instance, the worm evidently got into the tonsil at a very early stage.

The older worms, as is well known, have a distinct tendency to crawl into narrow places, which leads them to make balls of themselves in the intestine, which, if made up of a large number of worms, may cause intestinal obstruction. I have reviewed several such instances in PROGRESSIVE MEDICINE in recent years. This proclivity makes the worm occasionally get into the appendix and into the Eustachian tube, and crawl out through the nose.

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[1] Journal of American Medical Association, February 20, 1915, p. 659.

There is a remarkable instance which occurred in an idiot boy in an institution. He was doing kindergarten work with large various colored glass beads. These he swallowed in large numbers. The intestinal discomfort following was attributed to worms, and he was given a vermifuge, when it was found that he really had worms, most of them being passed threaded through a glass bead, the small opening of the object proving an irresistible temptation to the worm to imprison itself.

**Balantidiosis.** The Emetin Treatment of Balantidiosis. This is a rare form of infection but one which at times may cause diarrhea, particularly in the tropics. Axter-Haberfeld[1] has reported a case from Brazil that occurred in a woman sixty years of age who had a severe diarrhea for four months and resisted ordinary forms of treatment. The patient was very much emaciated and weakened, and was having from eight to ten stools a day, which contained mucus and pus and very often blood. Very large numbers of Balantidium coli were found in the stools and the patient was given an injection of 0.03 gram of emetin. The success of this treatment was surprising. Within the next twenty-four hours the patient had but one stool. This amount of emetin was repeated daily until the patient had been given 0.25 gram of the drug. After the three injections the organisms had disappeared entirely from the stools, the blood and pus had disappeared, and the patient made an uneventful recovery and has been well since.

**Blastomycosis.** Since Gilchrist first described a case of this disease in 1894, there have been numerous contributions on the subject, and a large number of cases have been reported from various parts of the United States. Following the first announcement of Gilchrist, he, together with Stokes, reported a case in which the skin of the eyelids was involved, and which led to the destruction of the lids of both eyes. Since that time a number of ophthalmologists have called attention to its importance as a disease of the eyelids.

One of the latest reports concerning the disease in this regard is by Jackson[2] who reports 2 instances of the disease, 1 in a man aged sixty-eight years, in whom the disease started as a small nodule on the right cheek, and which gradually spread so that it involved not only the eyelids but the skin of the cheek and neck as well. An interesting feature of this case was that it had been seen by four competent ophthalmologists, and the diagnosis had been made of lupus, and also of skin cancer. The second case was in a woman, aged thirty-nine years, who had a swelling which she thought was a sty on the left upper lid. This gradually extended, and she, too, had two specialists besides her family physician, neither of whom apparently made the diagnosis.

The parasite which causes the disease has been the subject of considerable discussion, and it is generally referred to as a blastomyces, and

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[1] Münchener medizinische Wochenschrift, February 2, 1915, p. 152.
[2] Journal of American Medical Association, July 3, 1915, p. 23.

it has been variously classified as an oïdium, as a saccharomyces, and it has been suggested that it was allied to the coccidioides. Those who have studied the organism more recently are in doubt as to exactly where to place it. As a rule, it seems to enter through an injury, but in many instances there is no history of any trauma. It has been described in infants as early as four months, and it may occur at any time, even in old age. A large number of cases have been reported from Chicago, but among these were many individuals who probably were infected in the neighboring States. Cases have been reported from various parts of the United States, but the disease has not seemed to have attracted very much attention abroad. The diagnosis may be suspected when there is a lesion suggesting an epithelioma, the margin of which is soft and contains small abscesses. Similar minute abscesses are found in the ulceration. The diagnosis is to be established when the disease is suspected by examination of some of the lesion to demonstrate the presence of the organism. The disease is usually confused with epithelioma, tuberculosis, or syphilis. The diagnosis may be regarded as easy, if one has the condition in mind.

The best method of treatment is to use iodide of potassium internally in increasing doses. If desirable, the lesions may be curetted or treated with application of nitrate of silver or other similar caustic. In some instances the disease may get into the circulation and cause a systemic infection, a condition which is reviewed more or less fully in PROGRESSIVE MEDICINE for March, 1915.

**The Use of Alkalies in Asiatic Cholera.** There have been a great many different suggestions made in regard to the treatment of Asiatic cholera but most of them have not been on any very firm basis. One suggestion which seems to be more rational than the others is the use of alkalies, which have been advised just as most everything else has in the past. In Asiatic cholera there is a great loss of fluid from the body and with this fluid there is excreted large quantities of the body alkalies, particularly the sodium salts. Howland has shown this to be true of the severe cases of summer diarrhea in infants, and has suggested the use of large doses of bicarbonate of soda in the treatment of the cases of diarrhea with intoxication. The same suggestion has been made by Sellards in Asiatic cholera. Sellards found that patients with cholera are very apt to develop a nephritis and that this is apt to be accompanied by symptoms of intoxication, which are probably due to other things than the uremia alone. He found that these patients have remarkable tolerance for sodium bicarbonate which he has used in two epidemics with favorable results. It makes very little difference whether the acid condition of the blood is brought about by a diminished excretion of acid on account of the impairment of the kidneys, or whether it is due to the loss of alkali through the bowel, owing to the excessive purging. Early in the disease he suggests the use of a weak solution of sodium

bicarbonate, 0.5 to 1 per cent., but later when the symptoms of intoxication begin, the drug should be given in very large quantities and this is particularly true if the patients are comatose or have any air hunger.

**Diphtheria.** THE SCHICK REACTION. Last year I called attention briefly to the Schick toxin reaction for immunity in diphtheria. Since that time there have been quite a number of contributions, several of which are well worth consideration, but the final judgment as to the exact value of this test as regards its practical value must be deferred for several years, but it is highly probable, however, that this is one of the reactions which, in its present form, or some subsequent modification, will become part of the routine of clinical medicine. The test will have two uses, one in testing persons for natural presence of antitoxin, particularly when they have been exposed to infection, and, secondly, to determine the degree of immunity obtained following injections of antitoxin mixtures. Those who react positively to the test may be regarded as susceptible to diphtheria, and require passive immunization by means of injecton of antitoxin. For determining the amount of antitoxin present in the blood, Römer's intracutaneous guinea-pig method has been used, but it is too complicated for the routine examination of many individuals. Schick's test, which was published in 1913 in the *Münchener Medizinsche Wochenschrift*, consists of injecting $\frac{1}{50}$ of the minimum lethal dose of diphtheria toxin for a guinea-pig weighing between 250 and 300 grams. This toxin Schick diluted to 0.1 c.c., while Park used the same amount, but so diluted that it was contained in 0.2 c.c. Kolmer and Moshage[1] have adopted $\frac{1}{40}$ of this amount of toxin, and this is diluted with sterile normal salt solution containing 0.25 per cent. of phenol, so that the dose is contained in 0.05 c.c. They believe that with this amount so diluted, there is less trauma and fewer doubtful reactions. The dilutions have to be made fresh every two or three weeks, as it deteriorates more or less rapidly, and it is necessary to keep it in a low temperature.

The technic, as described by Kolmer and Moshage, consists of pinching up a fold of skin, and inserting the needle of the syringe directly into the epidermis. As the toxin is injected, a whitish spot appears which causes a slight stinging pain, and if this slightly raised anemic area is not seen, it may be assumed that the injection has probably been made under the skin and too deep to give a satisfactory reaction. They use a very fine needle, No. 26, and a perfectly adjusted syringe is also necessary. After twenty-four to forty-eight hours there is a reaction characterized by an area of redness, with a slight brownish tinge, and this varies from 0.5 to 2 cm. in diameter, and there is a slight edematous infiltration of the tissues beneath it. In negroes, the erythema can usually be seen, but not sufficiently well to measure, but the

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[1] American Journal of Diseases of Children, March, 1915, p. 189.

edema is readily palpable. The height of the eruption is reached in from forty-eight to seventy-two hours, and then it fades during the next week or ten days. During this time there is some itching and a slight brownish pigmentation of the area follows for several days. There is also usually a slight superficial scaling. In most cases there is no general reaction. They reduced the amount injected to 0.05 c.c., so as to reduce the trauma to a minimum, as one occasionally gets reactions which it is difficult to tell whether they are purely traumatic reaction or a weakly positive result. When the area is more than from 3 to 5 mm. in diameter, it may be regarded as positive, but a very faint areola, with no palpable infiltration about the needle hole, may be regarded as negative and due to trauma.

Park and others have described a few cases which give what they call a pseudoreaction, which is characterized by a less sharply circumscribed lesion, which comes on earlier and disappears in from twenty-four to forty-eight hours, leaving a slightly pigmented spot, which does not scale. These reactions have been thought to be due to a local anaphylaxis due to the protein content in the bouillon medium. Kolmer and Moshage regard all reactions, except those evidently traumatic, as positive.

The time at which the reaction is to be read is a matter of considerable interest. If the individuals tested have been exposed to diphtheria, the reaction should be inspected at the end of twenty-four hours and again at the end of forty-eight hours. This second inspection will suffice to differentiate the pseudo and the true reactions. Very small areas of redness only 2 or 3 millimeters in the largest diameter may be regarded as of purely traumatic origin. In questionable cases, it is better to give the patient the benefit of the doubt if he has been exposed to diphtheria, and immunize him at once if the reaction is present. Some authors advise the use of a control fluid such as 1 to 10 or 1 to 100 bouillon injected in the same amount and the same manner as the diluted toxin and this is especially indicated in those suffering with scarlet fever and measles.

The question of necrosis after the reaction is one of considerable practical interest. Schick found that he had some sloughing when he used the stronger solutions of the toxin, and it seems that the same thing may happen when too large quantities are injected. Lucas[1] states that in 400 children there were 21 per cent. with some necrosis. There were none due to infections, as cultures remained sterile. In a few cases there were large blebs which broke and became necrotic. These, however, usually healed readily.

Another method, similar to the von Pirquet cutaneous test, consists in scarifying two places on the forearm, and then a drop of the diluted

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[1] Journal of American Medical Association, August 14, 1915, p. 588.

toxin is applied to the lower of the two areas and gently rubbed in. At the end of from twenty-four to forty-eight hours a similar area of erythema could be readily be seen about the inoculation site in most persons who show a positive intracutaneous reaction. The intracutaneous method is to be preferred as giving more definite results and being less painful. Kolmer and Moshage applied the test in 447 persons, and 159 were positive and 288 negative; in other words, 41 per cent. were positive.

From the results of their studies, both Schick and Park have arrived at about the same conclusions, and these have been verified by other workers in so far as observations have been made. They found that about 80 per cent. of the newborn contain a sufficient amount of antitoxin in the blood to be immune, but this number lessened so that the greatest period of susceptibility to the disease is from the end of the first to the end of the fifth year, during which time from 50 to 60 per cent. of the children contain sufficient amount of antitoxin in their blood to be immune. After this period the percentage gradually rises until among adults about 90 per cent. will be found to be immune. This immunity of grown people may be explained by their having had the disease, or their having had mild unrecognized attacks producing immunity, or to being subjected for periods of time to the continued action of diphtheria bacilli without having actually developed the disease. That will be noted later in the cases of doctors and nurses in infectious disease hospitals.

For the purposes of the practising physician, it may be assumed that if the reaction is positive, the blood of the individual contains less than $\frac{1}{30}$ unit of antitoxin to 1 c.c. of blood serum, and such persons may be regarded as susceptible to diphtheria. Various observers have given different figures, but these are more or less unimportant. It must be remembered that even if susceptible individuals are exposed to the disease, they do not of necessity contract it. Faint reactions mean the presence of small amounts of antitoxin, and if the reaction is negative it may be assumed that the patient contains somewhere between $\frac{1}{20}$ and $\frac{1}{30}$ unit of antitoxin per cubic centimeter, and that these individuals are not susceptible to diphtheria. In some individuals the amount of antitoxin present is exceedingly high, as much as 10 units per c.c., and possibly even higher than this. These large amounts were found in about 5 per cent. of those tested. The exact amount of antitoxin in the blood necessary to afford immunity apparently lies somewhere between $\frac{1}{10}$ and $\frac{1}{30}$ unit per c.c., except where the infection is due to organisms of exceptionally high virulence, which will probably explain the recurrence of diphtheria among persons ordinarily insusceptible to it during certain very severe epidemics.

In the newborn, Park believes the immunity is due to the child's taking in a certain amount of antitoxin in the colostrum. In fact, he

believes that the relatively high immunity for most infectious diseases found in early life is due to protective substances absorbed from the colostrum.

In children who are taken sick with diphtheria there are no protective bodies in the blood, or not in sufficient quantities, and these are found to give the positive reaction. Diphtheria carriers, as a rule, give negative reactions, and do not suffer themselves from the presence of even virulent diphtheria bacilli in the upper air passages. Some of these individuals are found to contain large amounts of antitoxin in the blood. Kolmer and Moshage found a few instances in which diphtheria convalescents harboring bacilli virulent for guinea-pigs reacted positively to the skin test, but showed no clinical evidences of diphtheritic intoxication.

Bundesen found that 70 per cent. of the carriers examined gave a negative reaction, while in 30 per cent. there was a slight reaction.

Park has called attention to a curious fact in relation to children of the same family. If the youngest child in the family is negative, it will be found that the reaction will be negative in all of the other children. If any react positive, they are all apt to give the same reaction, while if there is any variation, the older children will be found negative, while the younger children will be found positive.

There are a great many details to be worked out with reference to the use of the test, but we have a certain amount of information already. One point is that no immunity is conferred by the small amount of toxin used in making the test, as persons continue to give the reaction time after time unless they are immunized with a dose of antitoxin. The test may be used for determining the length of time for which immunity persists after the injection of a dose of antitoxin, and it is found that after ten days' time the antitoxin begins to disappear from the blood, and that it has practically all disappeared after four weeks' time. This question of the destruction of diphtheria antitoxin is one of considerable interest. Park found that if a guinea-pig received 10 units of antitoxin obtained from a horse, that is, a heterologous serum, there was only $\frac{1}{2}$ unit left at the end of seven days, and $\frac{1}{20}$ unit at the end of fourteen days. When, on the other hand, a guinea-pig was given 10 units of guinea-pig antitoxin, that is, an homologous serum, there was one unit left at the end of fourteen days. Matthews reports an instance in which he gave a 4-kilogram child 350 units of an homologous serum. The antitoxin content of the blood reached $\frac{1}{2}$ unit per c.c., and one month later the blood still contained $\frac{1}{20}$ unit per c.c. In almost every non-fatal case of diphtheria there is an active production of antitoxin on the part of the body, due to the absorbed diphtheria toxin. Park mentions a case in which the blood showed 60 units per c.c. at the end of the fifth day, 90 per cent. of which was produced by the patient. This, of course, is much above the average.

Kissling, in Hamburg, made a study of the production of antitoxin

among doctors and nurses working in the diphtheria wards. Those who had been working in the wards for a long time, but who had never had any clinical evidence of the disease, showed high amounts of antitoxin in their blood serum, while those recently assigned to duty showed low amounts, and frequently contracted the disease.

Park also made some studies with regard to the destruction of the antitoxin in scarlet fever cases, and found that these patients showed a decided increased susceptibility to diphtheria, and that, even after the injection of antitoxin, 10 per cent. were again susceptible after ten days had elapsed.

It is interesting to compare the results obtained by various observers, and the following tables of Park, Zingher and Serota, Schick, and Kolmer, furnish the data from which the general conclusions have been drawn:

### PARK, ZINGHER AND SEROTA.

| Age. | Total. | − Schick. | + Schick. | Per cent., + Schick |
|---|---|---|---|---|
| 6 months to 1 year | 5 | 3 | 2 | 40.0 |
| 1 to 2 years | 40 | 14 | 26 | 65.0 |
| 2 to 4 years | 145 | 48 | 97 | 66.8 |
| 4 to 6 years | 142 | 71 | 71 | 50.0 |
| 6 to 8 years | 94 | 61 | 33 | 35.1 |
| 8 to 15 years | 150 | 111 | 39 | 26.0 |
| 15 years and over | 124 | 93 | 31 | 25.0 |
| | 700 | 401 | 299 | 43.0 |

### SCHICK'S RESULTS.

| Age. | Total. | − Schick. | + Schick. | Per cent., + Schick. |
|---|---|---|---|---|
| Newborn | 291 | 275 | 16 | 7.0 |
| First year | 42 | 24 | 18 | 43.0 |
| 2 to 5 years | 150 | 55 | 95 | 63.0 |
| 5 to 15 years | 264 | 133 | 131 | 50.0 |
| | 747 | 487 | 260 | 34.9 |

### KOLMER AND MOSHAGE.

| Age, years. | Total tested. | Reactions. Positive. | Reactions. Negative. | Per cent., positive. |
|---|---|---|---|---|
| Under 1 | 25 | 3 | 22 | 12.0 |
| 1 to 2 | 21 | 9 | 12 | 43.0 |
| 2 to 4 | 18 | 12 | 6 | 66.0 |
| 4 to 6 | 12 | 7 | 5 | 58.0 |
| 6 to 8 | 14 | 8 | 6 | 57.0 |
| 8 to 15 | 21 | 5 | 16 | 24.0 |
| 15 to 30 | 142 | 60 | 82 | 42.0 |
| Over 30 | 194 | 55 | 139 | 28.0 |
| Total | 447 | 159 | 288 | 41.0 |

Park's cases in children from one to five were made largely on children suffering with scarlet fever, which probably explains the higher percent-

age of positive reactions, as scarlet fever reduces resistance to diphtheria, as is shown both by the clinical facts and a higher percentage of positive toxin reactions among persons with this disease. The number of persons giving a positive reaction would naturally show a higher percentage than those who actually contracted the disease, as not every susceptible person is exposed to diphtheria sufficiently to contract it.

Park attempted to trace a number of patients who had definite tonsillar exudates with positive cultures. Thirty-two such patients, who had been treated at the Willard Parker Hospital three or four months before, were tested, and 19 of the 32 gave positive reactions, while 13 were negative. He also cites 15 children, 7 of whom had had diphtheria about one year previous to the test, and, of these, 5 gave a positive, and 2 a negative reaction; and 8 cases that had had the disease about four months prior to the test, and, of these, 7 gave a positive, and 1 a negative Schick reaction. Two other children who had had a mild clinical diphtheria without antitoxin were tested, 1 two weeks and 1 three months afterward, and both gave positive reactions, while a nurse who had had diphtheria about a year previous also showed a positive reaction. The tube cases who had been in the hospital for more than a year, as a rule showed negative results. Patients at the Willard Parker Hospital who had had diphtheria within two or three months, frequently give positive reactions, which become negative if they remain for another five or six months. Park concludes from this that the diphtheria patients develop, as a rule, an antibacterial immunity, which is associated in only about one-third of the cases with an antitoxic immunity. When the children remain a long time in the diphtheria wards, chronic reinfections with the diphtheria bacillus finally lead, in the majority of cases, to an antitoxic immunity.

These results are particularly interesting in connection with the results of Park's work in immunizing with mixtures of diphtheria toxin and antitoxin. These children were divided into two groups; in the first group there were 68 children, of whom 44 showed the presence of natural antitoxin, and all of these gave a decided increase in the antitoxin of the blood after the injections, and none of these developed diphtheria. The remaining 24 had no perceptible natural antitoxin, and of these, 6 produced antitoxin after the injections, while 18 did not. None of the 6 developed the disease, while 5 out of the 18 developed clinical diphtheria. Following this, a second group of patients were selected who had no natural antitoxin, as shown by a blood examination and also by a positive Schick reaction. Of these 90, 20 developed sufficient amount of antitoxin to protect against diphtheria, while 70 failed to respond, though some gave a fainter Schick reaction than they had shown before immunization. Among the 20 cases no diphtheria developed. Of the 70 who produced no antitoxin, 17 developed clinical diphtheria twelve days and more after the injection.

Kolmer and Moshage studied the duration of passive immunity to diphtheria in 108 children, varying in age from two months to three years, all of whom had received 1250 units of antitoxin by subcutaneous injection at varying intervals of time prior to the test. This amount of antitoxin conferred an immunity which was apparently efficient for ten days, and after this interval the antitoxin rapidly disappeared, so that after four to six weeks the immunity may be regarded as having entirely disappeared.

### THE TOXIN SKIN REACTION IN CHILDREN WHO HAD RECEIVED 1250 UNITS OF ANTITOXIN.

| Days after injection of antitoxin. | Total. | Toxin skin reaction. | | Per cent. positive. |
| --- | --- | --- | --- | --- |
| | | Positive. | Negative. | |
| 1 to 5 | 10 | 0 | 10 | 0 |
| 5 to 10 | 18 | 0 | 18 | 0 |
| 10 to 20 | 12 | 3 | 9 | 25.0 |
| 20 to 30 | 14 | 4 | 10 | 28.5 |
| 30 to 50 | 36 | 13 | 23 | 36.1 |
| Over 7 weeks | 16 | 7 | 9 | 43.7 |
| Total | 106 | 27 | 79 | |

Their conclusions in regard to the duration of passive immunity following injections of diphtheria antitoxin in children suffering with scarlet fever coincide with the opinions and observations of Park.

Another point of interest is asserted by Schick; there may be changes in the immunity of the individual. This is a fact that has been known clinically for a long time and it is an old observation that nurses who go on service in diphtheria wards, when tired or if they work for hours, are more liable to contract the disease than otherwise. Neff[1] has recorded an instance of a child who gave a negative reaction and who developed diphtheria four weeks later.

Another use for the Schick reaction has been suggested and reported upon by Moffett and Conrad,[2] namely, to differentiate between doubtful membranes of the throat. In cases in which there is a membrane and also a positive Schick reaction, it can be assumed that the disease is diphtheria, but if the Schick reaction is negative the membrane will probably be found to be due to some other organism. This point will need further investigation since observers report very few cases, but in children's hospitals and schools this reaction ought to prove of great value in this connection. They also call attention to the similarity reactions in families, which indicates that immunity is a family condition. This has been noted by comparatively all observers. Other

[1] Journal of American Medical Association, August 14, 1915, p. 585.
[2] Ibid., September 18, 1915.

contributions on this subject have been made by Weaver and Maher,[1] by Birnberg,[2] Bundesen,[3] Graef and Ginsberg,[4] Moody,[5] Veeder,[6] Schick,[7] W. H. Park, Abraham Zingher,[8] and H. M. Serota.[9]

DIPHTHERIA BACILLUS CARRIERS. The question of prophylaxis of diphtheria would be very simple if it included only the recognition of the patients suffering from the disease and their isolation. Unfortunately, the disease is not only frequently spread in mild and recognized cases, but also by the carriers, the latter having of recent years been very carefully studied, as they offer one of the difficult problems in practice. The greatest difficulty has been to separate the dangerous from the harmless cases of carriers of diphtheria bacilli, or of pseudodiphtheria bacilli. These two organisms resemble each other very closely, and it seems highly probable that the pseudodiphtheria bacilli are closely related to the virulent organism, or they may be diphtheria bacilli that have lost their virulence for some unknown reason. The ordinary method of distinguishing these organisms has been to grow cultures on Loeffler's blood serum, and after twenty-four hours, if the growth shows Gram-resistant bacilli having the morphology of the diphtheria organism, to inoculate this into guinea-pigs, the virulent organisms killing the animal, while the avirulent do not affect it at all. This method is one which cannot be applied easily, and certainly not in all cases, and is perhaps not free from certain sources of error. The suggestion of differentiating these organisms by staining methods, such as that suggested by Neisser, of course cannot be used, as one occasionally meets with diphtheria bacilli which are virulent, and yet without granulations at certain periods of their existence, and on the other hand, beautifully staining polar bodies are found in what are recognized to be pseudodiphtheria bacilli.

Another suggestion was to grow the cultures in solutions of sugar colored with litmus, but this has been found unreliable, but in the medium suggested by Thiel, consisting of peptonated broth with glucose and litmus, and in that suggested by Rothe, which consists of blood serum agar, with 1 per cent. sugar, the diphtheria bacillus produces

[1] Journal of Infectious Diseases, March, 1915, p. 342.

[2] St. Paul Medical Journal, 1915, p. 204.

[3] Journal of American Medical Association, April 10, 1915, p. 1203.

[4] Ibid., p. 1205.      [5] Ibid., p. 1206.

[6] American Journal of Diseases of Children, August, 1914.

[7] Spezifische Therapie der Diphtherie, Centralblatt f. Bacteriologie, 1913, vol. lvii, Part 1; Ref., Beiheft, p. 16; Die Diphtherietoxin-Hautreaktion des Menschen als Vorprobe der Prophylaktischen Diphtherieheilseruminjektion, Münchener medizinische Wochenschrift, 1913, lx, 2608.

[8] Practical Applications Obtained from the Schick Reaction, Proceedings of New York Pathological Society, October, 1914.

[9] The Schick Reaction and its Practical Applications, Archives of Pediatrics, July, 1914.

fermentation, while the pseudodiphtheria bacillus does not. Unfortunately, this test is not reliable, owing to the possible contamination of other organisms, and also to apparent variations in either organism.

Lesieur[1] has made the following suggestion: If the bacillus comes from a patient with evident signs of the disease, or one that is convalescent, one ought to consider the organism as virulent. Then he suggests taking all the usual precautions with such individuals. If, however, the carrier is clinically healthy, and especially if the type of bacillus found is short and not granulated, does not ferment sugar, and if the carrier has not been in contact with actual cases of diphtheria, one may regard the organism as a pseudodiphtheria bacillus. A suggestion has been made by this author in the treatment of diphtheria carriers, which consists of inhalations of vapor from a mixture of alcohol and iodine, such as was suggested by Vincent and Bellot as treatment for meningococcus carriers.

A very valuable study on this subject has been made by Goldberger, Williams, and Hachtel.[2] The studies are part of an investigation started in the city of Detroit, Michigan, during the winter of 1913–14. For nearly a year prior to the commencement of this investigation, diphtheria had been unusually prevalent in Detroit, but before the cultures were made there had been a marked decrease in the number of cases and deaths. Most of the previous studies on the subject of diphtheria carriers have been made upon the inmates of institutions or have been restricted to one or two particular classes of persons, as school-children, students, patients at clinics, etc. Coincidentally, studies were made on the comparison of the relative values of cultures from different sources, on the tests of virulence, on the acid productions, and observations on Hoffman's bacillus. In the period between December 22, 1913, and March 4, 1914, a total of 4093 apparently healthy persons and 95 persons suffering with symptoms of clinical diphtheria were examined. This represents a total of 9489 cultures in all. Some of the cultures were taken from children visiting the daily clinics, on a few occasions from workers in factories, and from going from house to house as far as possible on all persons found at home. An effort was made to have the distribution of the individuals as even as possible, but there is a disproportionately large number of females and children between the ages of five and fifteen. The cultures were made from the throat, the nose, or both, in each case on a single slant. From some individuals only a single culture inoculated from the nose and throat was taken. From others three cultures were secured at one time. Of the healthy individuals, 2 very shortly after the cultures were taken showing mild symptoms of diphtheria gave positive results, while 3 others

[1] Il Policlinico Sezione pratica, November 29, 1914, p. 1689.
[2] Bulletin 101, Hygienic Laboratory, United States Public Health Service.

with positive cultures gave definite history of exposure to very suspicious cases or to diphtheria. Excluding these 5, we have for consideration 4093 apparently healthy individuals without history of direct contact. These cultures show a total of 38 carriers, or about 1 per cent. of the population examined. These results were compared with the majority of other workers in this field. The authors, in reviewing the literature, find that the results above 2 per cent. are more frequently encountered than below this figure. In 1902 the Committee of the Association of Massachusetts Boards of Health reported on the examination of 396 patients in the East, among whom were found 1.39 per cent., and of 1154 in Minnesota, among whom were found 80 carriers, or 6.93 per cent. In 1907 von Sholly reported from 1000 persons, mostly children, throat cultures only being taken, and 56 were positive, or 5.6 per cent. The bacilli were all isolated in pure culture, and 18, or 1.8 per cent. of the persons examined, were virulent. In 1913 Moss reported and examined 1217 school-children in Baltimore, Md., and, of faculty members' homes, students' boarding houses of the Johns Hopkins Medical School, throat cultures only were taken. Among the school-children, 44, or 3.61 per cent., were found to be carriers. The organisms were isolated from 33 and tested for virulence, 6 being found virulent. In the other group of 2190, 45 carriers were found, or 3.48 per cent. The following table from Nuttall and Graham-Smith gives the findings of some other workers:

OBSERVATIONS ON PREVALENCE OF CARRIERS.

| Observer. | Number non-exposed persons examined. | Persons harboring virulent bacillus diphtheriæ. | Persons harboring non-virulent. bacillus diphtheriæ. |
|---|---|---|---|
| Parke and Beebe (1895) | 274 | 2 | 23 |
| Kober (1899) | 588 | 0 | 3 |
| Denny (1900) | 235 | 0 | 1 |
| Cobbett (1901) | 43 | 0 | 0 |
| Cobbett (unpublished) | 90 | 0 | 0 |
| Pugh (1902) | 415 | 0 | 17 |
| Graham-Smith (1903) | 362 | 0 | 1 |
| Pennington (1907) | 125 | 2 | 11 |
| Total. | 2132 | 4[1] | 56[2] |

A study was made of the relative value of the different types of culture. The question of how many and what cultures to take in examining individuals for the purposes of releasing them from quarantine or searching for carriers is of considerable importance. Multiple cultures make an increase in the amount of trouble and expense. The following table shows the number of the different types of cultures furnished by the 4093 individuals and also the numbers of carriers disclosed by each method of culture.

[1] 0.18 per cent.　　　　　[2] 2.62 per cent.

| Type of culture. | Number of cultures. | Total number of individuals furnishing cultures. | Number of carriers. | Per cent. carriers. |
|---|---|---|---|---|
| Throat . . . . . . . . . . | 2666 | 2666 | 14 | 0.525 |
| Nose . . . . . . . . . . | 2350 | 2350 | 16 | 0.680 |
| Combined nose and throat . . . . | 3742 | 3742 | 26 | 0.694 |
| 2 cultures, 1 from nose and 1 from throat | 4690 | 2345 | 24 | 1.023 |
| 3 cultures, 1 from nose, 1 from throat, and 1 from both throat and nose . . . | 6957 | 2319 | 26 | 1.121 |

This shows at a glance the relative value of each. The low rate of the throat cultures is obvious. This is most often used in public health work, and where it is used alone it is quite evident that a considerable percentage of carriers is overlooked. Slightly higher results are noted by the use of a single combined nose and throat culture, and a decidedly higher result by using two cultures, one from the throat and the other from the nose. The combined results of the three simultaneous cultures shows the greatest percentage of positive results, but is not strikingly higher than for several nose and throat cultures. If possible, several cultures should be taken from the nose and throat. If this is not possible on account of the expense, a combined culture from the nose and throat, using separate swabs for each, is to be recommended. Some similar studies were made on a limited number of cases taking, for each, one nose culture and one combined culture at the same time. Positive results were obtained in one or more of the same cultures from each of the 42 cases. Comparing the results from the different cultures it was found that of the 42 throat cultures, 34, or 80.1 per cent. were positive. Further examination of the results shows that in 18 cases the throat culture was positive when the nose culture was negative, while in 5 cases the reverse was true. In 3 cases only, the combined culture was positive while the throat culture and the nose culture were both negative. These results indicate that no single culture in clinical cases gives 100 per cent. results, but that, as might be anticipated, a throat culture comes nearer to this than any other single culture. The test for virulence was made in 19 cases in which the organisms were isolated in pure culture out of the 38 carrier cases found. All of these were tested, and 2 found virulent. On this basis, it may be assumed that 4 of the 38 cases harbored virulent bacilli. This result is somewhat lower than the rate compiled by Graham-Smith, namely, 0.18 per cent. There was a wide range of ages among the persons found with cultures, the youngest was four years of age, and the oldest seventy-two. Four carriers were sixty years old or older, the others ranging between these ages. Twelve were in males, and 26 were in females.

THE INTRAVENOUS INJECTION OF DIPHTHERIA ANTITOXIN. The use of diphtheria antitoxin has had a marked effect on the death-rate, and yet the lowering has not been as great as it should be. Following its introduction there was a marked fall in the death-rate, both in American

and European cities, but in recent years there still continues to be what would seem an unnecessary number of fatal cases of diphtheria. This is probably very largely due to the fact that many laymen and physicians are either afraid to use antitoxin at all, or do not use it until it is too late, or use it in insufficient quantities. A few deaths are probably due to unusually virulent strains of diphtheria bacilli. The experience of the Chicago Department of Health showed that in cases treated by antitoxin, those injected on the first day gave a mortality of 0.27 per cent., on the second day, 1.67 per cent., on the third day, 3.77 per cent., on the fourth day, 11.39 per cent., and those injected later 25.37 per cent. This coincides with the experience of everyone who has had much experience with diphtheria, and the first inference to be drawn is that antitoxin should be used in sufficient quantities as early as possible.

Inasmuch as both in hospital and ordinary practice one frequently sees cases in which several days have elapsed and which have not received antitoxin, and in order to cope with these cases, some method other than the ordinary subcutaneous injection must be resorted to. Park and others have suggested the intravenous injection of the antitoxin, not in all cases, but in those seen late. Park believes that 5000 units introduced intravenously are as beneficial as 20,000 units injected subcutaneously. Six hours after injection the blood serum contains 20 units per cubic centimeter of blood, as against 2 when the injection is made subcutaneously. After twenty-four hours have elapsed, there are 12 units when given intravenously, and 6 when injected subcutaneously. The reason that the intravenous injection is not more often practised is owing to the difficulty of doing it satisfactorily in children. Where it has been done, the technic suggested by Wollstein for obtaining blood cultures in infants and young children is generally used, and this method uses the external jugular vein.

Schorer[1] has given the results obtained in 14 children in which the antitoxin was introduced by the intravenous method. Comparisons were made with 7 children in the same epidemic who received antitoxin subcutaneously. This number of cases is entirely too small from which to draw any definite conclusions, but, following intravenous injections, the fever and membranes disappeared sooner, and recovery took place more rapidly, the bacilli disappeared from the throat in a shorter space of time, and there were fewer carriers and less paralysis than when subcutaneous injections were used. In a few of the cases there was a slighter immediate reaction, coming on in from one-half to one and a half hours. This consists of a chill, followed by an elevation of temperature, and in 2 cases there was some respiratory distress. All of these symptoms disappeared in from three to twenty hours, after

[1] American Journal of Diseases of Children, January, 1915, p. 59.

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which the patient felt entirely well. There were no serum rashes later on in these cases.

INTRAMUSCULAR INJECTIONS OF ANTITOXIN IN DIPHTHERIA. This subject has probably not received the attention that it deserves. Rolleston and McLeod[1] have called attention to this method of administering antitoxin which was begun as a result of Morgenroth's investigations on the subject of intramuscular injections, and was probably first used in Neisser's Clinic, at Stettin. Intramuscular injections of drugs have been employed for some forty years, but little was done, however, until Meltzer and Auer showed that the intramuscular injections were more rapidly absorbed than the subcutaneous. In a large number of the German clinics this method is now given a preference, and in some few places outside of Germany it has also been used. The injection may be given either in the gluteal region or in the outside of the thigh. The skin is painted with iodine, and the antitoxin injected directly into the muscles. This is less painful than the subcutaneous administration and is much less difficult than the intravenous injections. Rolleston and McLeod prefer the thigh to the gluteal region, as there is much less probability of injury to important vessels, and they believe that absorption is more rapid than in the gluteal region. The injections can be made into the gluteal region if attention is paid to the location. There are two places which are to be recommended, the first, a point midway between the anterosuperior spine and the top of the internatal cleft. The needle will go forward, outward and slightly upward. In thin children there is not much tissue at this point. The second location is found by drawing a line from the top of the great trochanter to the top of the internatal cleft. The injection should be made at the juncture of the inner and middle thirds. This has the objection of being near the gluteal vessels. If the injection is given into the thigh, the vastus externus is chosen as the site of injection.

THE OCCURRENCE OF HERPES IN DIPHTHERIA. While it is a well-known fact that herpes is one of the frequent complications of diphtheria, comparatively few observations have been made on this subject. Rolleston, in his series of cases, found it in about 4 per cent., and Reiche, in the recent epidemic occurring in Hamburg during which there was some 5000 cases, noted it in 6.9 per cent. Rall,[2] in making a study of the herpes in this epidemic, examined the contents of the vesicles in 94 cases. In 78 of these the eruption was on the lips, in 10 cases on the nose, in 5 cases on the cheeks, and in 1 case on the buttocks. In 26 of these cases, that is in 27.65 per cent., the diphtheria bacilli were demonstrated in the vesicles. In the cases with the herpes on the lips they are found in 18 cases, or 23.07 per cent., and in 2 cases in which it occurred on the

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[1] British Journal of Children's Diseases, July, 1914.
[2] Münchener medizinische Wochenschrift, March 23, 1915, p. 369.

cheeks, or 40 per cent. When the herpes occurred on the nose there was a positive result in 6, or in 60 per cent. of the cases. In the 1 case having a herpes eruption on the buttocks, diphtheria bacillus was not found. The bacilli were found more often in the cases complicating severe diphtheria than in the milder forms.

**Foot-and-mouth Disease.** The recent epidemic of this disease among animals has given rise to considerable discussion about the disease, especially its prevention. It seems quite probable that, in man, most of the cases are due to the use of unboiled milk or other dairy products. Mohler[1] states that this may easily be avoided by pasteurizing the milk at a temperature of 60° C. for twenty minutes.

**Acute Lymphatic Leukemia.** Simon and Judd[2] have published some observations on lymphatic leukemia. Last year, Steele[3] isolated an organism from a case of acute leukemia which he regarded as similar to the organism which has been described in Hodgkin's disease (see same). His patient is a boy, aged twelve years, that had an attack of toothache with swelling of the lymph nodes two years preceding. The disease began three weeks before admission to the hospital with a painful swelling on both sides of the neck, followed a week later with pain of the nodes in the axillæ and pain in the left upper abdomen. The tonsils were somewhat enlarged and the spleen could easily be palpated. Eighty per cent. of the white cells were lymphocytes, and there was a leukocytosis of 60,800. Following removal of the patient's adenoids and tonsils, the leukocytes rose to 220,000, with 99 per cent. of lymphocytes, and fell the following day to 1800, of which only 42 per cent. were lymphocytes, while the polynuclears rose to 55 per cent. There was a marked diminution in the size of the spleen, and the lymph nodes diminished markedly. Fifteen days later the lymph nodes and spleen increased in size, and the count rose to 9000, with no change in the differential count. Eight days later the total number rose to 236,000, with 80 per cent. of lymphocytes. Death occurred two weeks after this due to weakness and adenoid hemorrhages.

The organism which he isolated was decidedly pleomorphic. Most of the organisms resembled forms of the diphtheria bacillus, but some are short and coccoid. No definite branching forms were observed. Some stained uniformly, while others stained in a granular manner, and in some there was bipolar staining. The growths on agar and blood serum, and the general reactions, resemble that of the Bacillus hodgkini of Bunting and Yates, the so-called corynebacterium of Negri and Mieremet.

The patient studied by Simon and Judd was a man, aged twenty years, whose disease began six weeks previously with painful swelling

[1] Farmers' Bulletin 666, United States Department of Agriculture, April 22, 1915.
[2] Journal of American Medical Association, May 15, 1915, p. 1630.
[3] Boston Medical and Surgical Journal, 1914, clxx, 123.

in the right axilla. Soon other nodes began to enlarge, beginning with those in the back of the neck. He developed facial paralysis, and at this time his blood was examined and the nature of the disease determined. Death was due to an internal hemorrhage. The blood picture was that of a typical lymphatic leukemia. Blood cultures remained sterile, but a bacillus was grown from the patient's spleen which was removed one hour after death. The organism, which grew, resembled the Bacillus hodgkini both in the staining reaction and cultural characteristics.

**Herpes Zoster.** THE ETIOLOGY OF HERPES ZOSTER. This disease has been supposed to be due to some sort of infection, although there has been comparatively little positive evidence. A couple of years ago Sunde demonstrated a Gram-staining diplococcus in a hemorrhagic Gasserian ganglion in a case of ophthalmic herpes in an old man who died of bronchial pneumonia three and one-half days after the appearance of the herpes. Rosenow's work, on the tendency of organisms to localize in the tissues from which they are isolated, led him, in connection with Oftedal,[1] to make some experiments with streptococci. They claim to have produced herpes of the skin, tongue, or lips by the intravenous injections of cultures obtained from extirpated tonsils or from pyorrheal pockets or from the spinal fluid. Some of the animals also showed herpetiform lesions of the viscera. In these, the ganglion of the vagus or sympathetic nerves were found to be hemorrhagic. In the other cases the lesions were found in the ganglion corresponding to the location of the herpes. In six guinea-pigs herpes was produced by intraperitoneal injection.

**Hodgkin's Disease.** In PROGRESSIVE MEDICINE for March, 1914, I referred briefly to the observations of Bunting and Yates. They have recently contributed another article[2] which includes the results of some six years of observation. Numerous attempts have been made to isolate *organisms* from cases of Hodgkin's disease, and, as early as 1893, Ferdelli reported the finding of cocci and subsequently various cocci-bacilli were described. In 1895, Delbet isolated a bacillus which was not described but which was said to have caused characteristic glandular enlargements after intraperitoneal and subcutaneous injections into dogs. The production of glandular involvement by the injection of emulsions of glands has been tried, but, apart from the concomitant tuberculosis, the results have been negative. Spirochetes were said to have been stained in sections of typical glands,[3] and Fraenkel and Much[4] claimed to have found an organism which they regard as of glandular non-acid-fast tubercle bacillus. They were unable to grow this organism or to reproduce the disease by inoculating the animals with the filtrate

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[1] Journal of American Medical Association, June 12, 1915, p. 1968.

[2] Ibid., p. 1953.                    [3] White, Ibid., August, 31, 1907, p. 774.

[4] Zeitschrift f. Hygiene und Infectionskrankheiten, 1910, p. 159.

which contained it. It is quite possible that they were dealing with the organism which Yates and Bunting have described under the name of the Bacillus hodgkini. They defined the disease tentatively as a non-contagious, infectious, granulomatous process due to the Bacillus hodgkini, primarily localized at or about the portal of entry, which causes a progressive enlargement of a specific nature in adjacent and remote preëxisting lymphoid structures and early provokes characteristic changes in the blood picture. Once well established, the disease manifests little or no tendency to spontaneous recovery.

From the fresh tissue which shows the characteristic changes there can be grown almost constantly a non-acid-fast, Gram-positive anti-formin-fast, pleomorphic diphtheroid organism. It may also be stained in the affected tissue, where it may appear in large numbers and is apparently the only organism present. The subcutaneous inoculations of pure cultures into monkeys produces a series of changes quite similar to the disease, as manifested in its more acute form in the human being. The organism may be recovered in pure culture from the monkey in which the disease has become established, and this, in turn, is capable of causing similar lesions in other monkeys. Soon after the inoculation, the animals show the same blood changes as are observed in the spontaneous cases in human beings. Injections, made subcutaneously into the normal individual, of five, ten or twenty million bacilli of a polyvalent stock Hodgkin's vaccine at intervals of five days have produced, within four days of the last injection, the blood changes which Bunting has shown to be an almost constant characteristic of the disease.

Nothing is known of the occurrence of the Bacillus hodgkini outside of the human body. There is perhaps some clinical evidence that it may enter through the gastro-intestinal tract. It is interesting to note that diseases which have been called pseudoleukemia have been described in various domestic animals, as pigs, horses, chickens, and sheep. In the last-named animal it is thought that it may be transmitted by insects.

Our knowledge of the pathology of the disease is largely based on the studies of Reed, published in the *Johns Hopkins Hospital Reports* for 1902. She showed that, histologically, there is almost complete obliteration of the normal structure of the lymph nodes from the wide-spread proliferation of the endothelial cells. These cells are especially noticeable in small foci which give a fresh section an appearance suggesting miliary tuberculosis. It is very probable that in addition to the old idea of Hodgkin's disease there are numerous variations giving clinical pictures which are generally not usually classed as this disease. Thus, Bunting and Yates describe cases which were regarded as lymphoid sarcoma in which the blood pictures and the histological structure of the lymph nodes were identical with Hodgkin's disease, and an organism similar to the Bacillus hodgkini was cultivated from the tissues.

Another instance is a case which was regarded as chloroma in its most typical form, and this showed the characteristic blood picture, and what was regarded as the typical organism was isolated. In another instance a young man, who had, for seven years, periodic attacks of subcutaneous inflammation accompanied with pain, fever, delirium and leukocytosis, and with lymphangitis and lymphadenitis affecting one leg and causing very gradual enlargement suggesting elephantiasis, also showed the blood picture, and cultures were obtained from the subcutaneous fat. These are but a few of the variations that probably occur.

When the organism gains entrance to the body, the first change seems to be a lymphangitis which extends to the nearest lymph node where it causes the specific lymphadenitis. There are also changes about the lymph vessels and nodes. The progress of the disease is one of gradual extension in a similar way, sometimes acute and sometimes chronic. The advancement is usually in alternating waves of progression and regression, usually very irregular. Three stages of the disease may be roughly defined: First, one in which the process is localized and in which there is very little physical effect, but even at this stage there is a positive blood picture due to the toxemia. In the second stage, there is a definite toxemia and anemia, with considerable extension of the disease but comparatively slight physiological changes. In the third stage, there is very wide dissemination, with marked anemia, dysphagia, dyspnea, marked physiological effects and extreme toxemia, anemia, and cachexia.

The *diagnosis* is made difficult by the occurrence of secondary infections, of which perhaps tuberculosis is most important. The disease may start in the neck, the port of entry doubtless being the tonsil, but there may be other lesions in the mouth and the organism may gain entrance through carious teeth or through lesions about the teeth. Chronic rhinitis, pharyngitis and otitis media are other lesions which have apparently been the starting-point of the disease. The course of the disease depends upon the relative virulence of the infection. In the acute forms, death may result in from two to four months. In chronic forms, it may be prolonged up to five years. The diagnosis of the disease can only be definitely made by laboratory findings, the usual method being to demonstrate the typical lesions in portions of the tissue removed for that purpose, but there are instances, particularly in early stages of the disease, in which this may be difficult, if not impossible. Bunting and Yates believe that it is not permissible to make excisions unless the stage of the disease is such that the only hope lies in vaccine therapy if the value of this therapy becomes definitely established. The danger in making excisions is the dissemination of the disease. The diagnosis by bacteriological study has the same limitations; the culture is attained with difficulty and it may take some ten days before the organism grows satisfactorily. The blood has been studied for many years, and

the appearance usually presented has been summarized by Bunting and Yates as follows: There are two distinct types, the early and the late, showing a constant characteristic increase in the number of platelets, unless exhaustion of the bone-marrow occurs, with abnormally large forms and either a relative or absolute increase in the so-called transitional cells. In the early type the leukocytes are usually less than ten thousand. Very early there is a moderate increase in the basophilic cells, and when the disease is well established the eosinophiles are slightly increased. The polymorphonuclear neutrophiles remain within the usual limits, while the leukocytes are normal or slightly increased. The late type shows a leukocytosis which may reach one hundred thousand. The neutrophiles are increased to a percentage of from 75 to 92, and the lymphocytes are reduced to 5 per cent., frequently even less. The transitionals, the only other cells found in any numbers, are usually above 8 per cent. unless the leukocytosis are very high when there may be relatively fewer but still exceed the lymphocytes.

The disease is usually regarded as inevitably fatal within five years, and the *treatment* has been unsatisfactory. Bunting and Yates have attempted to remove the primary source of infection and to get rid of as much of the diseased tissue as possible and with it the bacteria and toxins with a view to preventing further dissemination and then a destruction of the remaining bacteria by various means, including the Röntgen rays, hygienic measures, and, more recently, the use of the vaccine. If the source of infection seems to be the tonsil, a complete pericapsular tonsillectomy is advised, and, in addition, the eyes, ears, nose, accessory structures, and teeth must be carefully examined as a possible site of primary infection. If the primary glandular involvement is not in the neck, search must be made for the source of infection and suspicious lesions treated appropriately. If a complete excision of the cervical glands can be done, this is usually undertaken, but any dissection less complete is contra-indicated. The exposed area is treated with full strength tincture of iodine and drained. Following this, the entire wound area is exposed to the Röntgen rays, starting not later than the second day, preferably within a few hours of the operation.

The Röntgen rays have produced numerous instances of marked improvement, but no permanent cure has been effected solely by this means. In addition to this treatment, the patient should be placed under the most favorable hygienic conditions possible. Since the discovery of the organism, vaccines have been used, both stock and autogenous, and some cases have shown encouraging results, although the changes obtained in other instances had no lasting value.

In the cases so far studied, vaccination has not exerted any great influence on the ultimate course of the disease, but the experiments are too limited in number to draw any definite conclusions. In 2 cases,

the histories of which are not given, they state that the blood pictures returned to normal and remained there. Recovery can only be said to be established when the normal blood picture has persisted for at least five years after the last visible manifestation of the disease.

These observations were confirmed by other observers in 1912 when Fraenkel announced that the organism in question had been demonstrated in more than 30 cases. Negri and Mieremet[1] succeeded in growing this organism, but owing to its pleomorphism, they doubted the purity of their cultures so that they resorted to Schauten's method of isolating a single organism from which a pure culture was then obtained, and in these cultures the same variability of size and form was noted as in the primary growth. They suggested the name of Corynebacterium granulomatis maligni (see Lymphatic Leukemia).

Olitsky[2] attempted to demonstrate the complement-fixation test in 10 different cases, 5 of which were Hodgkin's disease according to the histological diagnosis, 1 Hodgkin's disease from clinical diagnosis, 1 case in which the disease resembled Hodgkin's disease but the histological diagnosis was uncertain, although the gland showed chronic changes resembling those seen in Hodgkin's disease, 2 cases in which the histological diagnosis was lymphosarcoma, and 1 case in which the histological diagnosis was lymphatic leukemia. At the same time serums from patients suffering from other chronic diseases as syphilis, tuberculosis, pernicious anemia, carcinoma, etc., in all 34, were tested in a similar manner and the results were likewise negative.

Hatcher and Lemmon[3] reported a single instance of this disease treated by vaccine and the Röntgen rays. The patient was sixty-three years of age, and in February, 1914, he noticed swelling of the lymph nodes. In June one of the nodes was removed for diagnosis and for the preparation of an autogenous vaccine. This vaccine was begun July 1. Subcutaneous injections were given twice a week for seven weeks. The initial dose was 25,000,000, and this was gradually increased to 2,000,000,000. In addition to this, the patient was given the Röntgen-ray treatment every five days for eight weeks. He received six injections before there was any change, and after this the lymph nodes gradually reduced in size until they became about two-thirds the size they were at the time of the beginning of the treatment. On August 27 he was taken with appendicitis, and on September 8 he was operated on for this, and an abscess was drained. The drainage ceased about eighteen days after the operation. During this time there was an extremely rapid decrease in the size of the nodes, but with the cessation of the pus there was corresponding slackening in the retrogression of the nodes which did not entirely cease, but has continued up to the time of the report.

[1] Centralblatt f. Bakteriologie, Part 1, Originale 1913, lxviii, 292.
[2] Journal of American Medical Association, April 3, 1915, p. 1134.
[3] Ibid., October 16, 1915, p. 1359.

The patient feels perfectly well and is doing his work about the farm.

**Hookworm Disease.** OIL OF CHENOPODIUM IN HOOKWORM DISEASE. Last year I called attention to the reports of Motter and Levy in regard to the use of the oil of chenopodium in the hookworm disease. Bishop and Brosius[1] have made some observations of this same subject which are of particular interest, inasmuch as they were made in Panama City which affords an ample amount of clinical material. In administering the drug, the dose is followed four hours later by two ounces of castor oil. For adults, it may be put up in capsules of eight minims each, and for children it may be given with sugar. They have followed Young's rule for determining the dose, but it may be safe to say that one drop of the oil may be given for every year of the child's age and that this dose may be repeated twice, two hours apart. The use of oil of chenopodium has several distinct advantages, in proper doses it is non-toxic and it does not have to be used with dietetic restrictions or with excessive purging. The cost of the drug is very much less than thymol, and its administration is more simple and attended with less inconvenience. It can also be given at shorter intervals than thymol. Bishop and Brosius believe that, as a result of their observations, it is a much more efficient drug than thymol in the treatment of the hookworm disease. They found that it was also very effective in ascaris infections, a fact which has been known for a very long while, and that it had absolutely no effect on the Strongyloides intestinalis, Trichocephalus dispar or trichomonads.

**Kala-azar.** TREATMENT OF KALA-AZAR. Castellani[2] has made a report on a case of this disease in which he obtained great benefit from the use of tartar emetic. The individual was a coolie from India who had the disease in an advanced form. He was given, in addition, potassium iodide and sodium salicylate and also some Fowler's solution, but Castellani is of the opinion that the effective agent was the tartar emetic.

INFANTILE KALA-AZAR. This subject has attracted a very considerable amount of attention in recent years and last year, in the March number of PROGRESSIVE MEDICINE, I reviewed the subject at some length. I cannot, however, omit making a short reference to a most excellent study by Torrademe y Moline.[3] This article contains a resumé of our knowledge of the subject, together with some bibliographic references. The changes in the blood that they have noted are of considerable interest and consist of a diminution in the number of red blood cells, in the average case of 3,000,000 to 4,000,000 and as the disease progresses, the oligocythemia increases and there are other notable changes in the red cells, particularly a polichromatophilia. The changes

[1] Journal of American Medical Association, November 6, 1915.
[2] Pediatria, April, 1915, p. 241.
[3] La Clinica Moderna, June 15, 1915, p. 369.

in the white cells consist of a leukopenia. Most of the authors have noted an absence or diminution of the eosinophiles and an increase in the lymphocytes and large mononuclears. This increase in the mononuclears is compensated for by a corresponding decrease in the polynuclears. The author just quoted has not found, in his investigations, the same diminution of the lymphocytes as have been described by others.

**Kubisagari.** This affection, generally called the "disease of Gerlier," has been restudied recently by Couchoud.[1] This malady is very curious, in that it is apparently limited to two small areas, one on the borderland between France and Switzerland, and the other in Japan. In these areas it seems to be endemic, with a marked seasonal preference, and at times seems to occur in small epidemics. The disease does not seem to be limited to man, but also affects animals, particularly sheep, especially when they have been confined to pens.

The name usually applied is taken from the Japanese, and means "wry neck." In Ferney, where it was studied by Gerlier, the disease is known under the name of *tourniquet.* The first studies were made as early as 1886 by Gerlier, and subsequently the disease was described in Japan by Nakano.

The onset of the disease is sudden, and may come on while the individual is at work. It is characterized by three symptoms: A painful torticollis, paralysis of the arms, and a marked ptosis, with blindness or a lessening of the vision. In some instances there is marked vertigo, and it has been described as a vertiginous paralysis. When it attacks sheep, they are usually unable to feed. The disease is one of summer time, and is rarely seen in winter. The same individuals may be attacked year after year. The disease has been noted for some years in one village, and for some years in another. Couchoud believes he has discovered a microörganism in the form of a coccus, which he has isolated from the cerebrospinal fluid and from the milk. He also believes that he has been able to transfer the disease to cats. The recent studies of this disease may stimulate interest, and it is possible that it may be found in other places, and someone may confirm the observations that have been made upon it.

**Leprosy.** There have been a number of studies made on leprosy during the past year, one of which comes from the Penikese Hospital, and was done under the direction of the Department of Bacteriology of the Harvard University Medical School, by Honeij. The study was very largely carried out to determine the relation of temperature and pulse curve to the diagnosis and prognosis of the disease, and covered a period of twelve months, from July 14, 1913, to July 14, 1914. The observations were made on 17 patients, most of whom had been under constant observation for more than eighteen months. In normal indi-

[1] Revue de Médecine, April 10, 1914; Il Policlinico Sezione pratica, January 10, 1915, p. 64.

viduals the temperature and pulse-rate fall and rise together in parallel curves, but when the rate of pulse is increased by fever, there may be variations due to the different toxins producing the fever, and there are a considerable number of important differences. In certain of the exhausting diseases, such as cancer and anemia, there is an increase in the pulse-rate, probably due to some intoxication. In the ordinary febrile diseases, each degree of temperature is usually accompanied by a rise in the pulse-rate of from 8 to 10 heart beats, but there are notable exceptions, the pulse being slower in typhoid fever and in meningitis, and much more rapid in scarlet fever. In leprosy, Honeij believes that there is a definite clinical temperature and pulse curve, which has a diagnostic and prognostic value, the change being that there is a frequent persistent occurrence of a morning pulse-rate which is higher than the rate in the evening, and in the severe cases, as the disease progresses, the pulse-rate becomes higher, and remains constantly at a high level. From time to time, in leprosy, there occur phases which the author terms toxic febrile attacks, and these are most often followed by severe lesions, such as swelling, pustules, bullæ, and later, ulcers, local collections of pus, and severe involvement of the lymph nodes. Following these toxic febrile attacks, the pulse-rate is found to be high, but without the corresponding elevation of temperature. In the early cases the temperature and pulse-rate are correlated as in the normal individual, and this is quite in contrast to the gradual increase in pulse-rate without some temperature reactions noted in the progressive and advanced cases. The pulse and temperature seem to be more unstable than in many other diseases, so that very insignificant causes may cause very marked reactions, and there is also unusually marked irregularity in the temperature and pulse-rate from complications, and in some instances an unusually low evening temperature has been met with. A great many changes in the pulse- and temperature-rate are due to conditions of the patient; for example, sudden and sometimes continued rise in pulse-rate is noted after exercise, which is probably accounted for by the eliminations of toxins into the blood stream, and this is very similar to the conditions found in tuberculosis.

**Leukemia.** This whole question as to whether leukemia is an infection or not is of particular interest at this time. Banti and others have been responsible for the teaching that leukemia was to be regarded as a new growth, but since the early statements of Fraenkel, and others, there has been a steadily growing belief that it is an infection. It should be borne in mind that at the present time the leukemias cannot be classified into hard-and-fast groups as was done some years ago, and, indeed, the diagnosis of leukemia from other allied conditions may be extremely difficult. The observations of Turck, Cabot, Jackson, and others has made it perfectly clear that during or following infections about the throat there may be more or less general enlargement of the lymph nodes

together with the increase in the number of lymphocytes. Similar blood findings have been described in cases of streptococcus infection due to wound sepsis, in tuberculosis, and in general adenitis of tonsillar origin. Some of these cases have also been described following septic sore throat. In Cabot's cases the lymphocytes did not exceed 71 per cent. His cases were in adults. In Jackson's remarkable case, a college student, aged twenty-one years, following a sore throat and a slight enlargement of the lymph nodes of the neck, showed an increase of 40,000 white blood cells, of which 95 per cent. were mononuclear. In two months' time the blood picture had returned to normal. Ireland[1] has reported an instance in a boy, aged ten years, who had 97.5 per cent. of mononuclear cells with general enlargement of the lymph nodes, and, following the administration of neosalvarsan, the patient recovered. The Wassermann reaction was previously negative. The differential diagnosis between an acute leukemia and lymphocytes due to infections is exceedingly difficult at times. Cabot would base it on the lesser degree of lymphocytosis, the course of the disease, and the recognition of an infectious origin of the adenitis. To these we may add the amount of change in the red blood cells, and whether or not there is hemolysis. High lymphocyte counts have been noted by Herz in typhoid, pneumonia, and other infections. There have been numerous other observations, which need not be mentioned, all of which are most easily explained by assuming that the disease is due to some form of parasite. When we come to the question of the bacteria that have been reported in cases of leukemia, we have, in addition to the above observations, streptococci by some ten other observers, staphylococci by Herz, tubercle bacilli by Nanti, and so on. Anyone interested in this subject will find a more or less complete bibliography in an article by Wilbur.[2] Whether these organisms are the cause of the disease, or whether they are secondary invaders, is not prefectly clear. It would seem that if the disease is due to a parasite it is something which attacks the bone-marrow, the lymph nodes, and the spleen, sometimes one and sometimes another, and it will only be by further careful study that this difficult subject can be cleared up.

**Malignant Edema.** As might have been expected, the war in Europe has brought about a recurrence of disease, which, in civil practice, had almost entirely disappeared. The subject is not to be considered further than to call attention briefly to the appearance of the disease as described by Bell.[3] In previous wars, the mortality from this disease has been as high as 90 per cent. Bell believes that if the treatment is begun energetically as soon as the diagnosis is even suspected, the patients may be saved.

[1] Journal of American Medical Association, September 9, 1915, p. 948.

[2] Ibid., October 9, 1915, p. 1255.

[3] British Medical Journal, May 15, 1915, p. 843.

The onset is sudden but not especially painful, and generally follows large wounds. The wound instead of being red, turns black, and appears to be filled with decomposing blood-clot from which bubbles of gas issue either spontaneously or on pressure. In a few hours the appearance changes, and it either becomes dry and black and presents somewhat the appearance as if it had been seared with cautery, or, in other cases, it presents a dark gray slough not unlike a diphtheritic membrane. The surrounding skin for several inches is often dark in color and has a smooth, spreading, pseudo-ecchymosis about the color of iodine stain. At the end of twenty-four hours the affected part begins to swell, and it soon becomes markedly edematous. Upon pressure, one can sometimes elicit gas crepitus. In addition, there is a vile, pungent odor of remarkably penetrating power. At the end of forty-eight hours, if the patient is still living, the expression is very anxious and the skin of a sickly, greenish pallor. The mentality is not affected. The fever ranges from 100° to 105° F., and the pulse and respiration are in direct ratio to the temperature.

The treatment consists of making deep incisions down to the bone, 4 to 6 inches in length, and these are kept wide open with fenestrated rubber tubes one inch in diameter, passed through the muscles to a counter-incision. From three to six large openings were made in each case. The wounds are irrigated with solutions of hydrogen peroxide followed with carbolic acid 1 to 100. The wounds are lightly packed with gauze and the dressing and irrigation repeated every three hours. As soon as the checking of bleeding permits, the gauze drainage is removed and only a thin layer of gauze left to cover the wound, which is left exposed to the air.

**Malaria.** Intravenous Mercuric Chloride in Malaria. As is well known, there are certain cases of malaria which resist the usual treatment by means of quinine. Whether or not this drug is the best one to be used in the treatment of malaria, may be open to question. Barlow,[1] has reported a case of typical tertian infection in which the patient was having typical chills every other day for nine days and had had a single 5-grain capsule of quinine which had no apparent effect on the course of the disease or on the parasites in the blood. An intravenous injection of mercuric chloride was given at 10 a.m., the chill being due the same day at 4 p.m. There was no chill, but there was a slight fever, beginning at 2 p.m. and gradually increased to 101.6° at 5 p.m. and then gradually subsiding. The patient had no other medication and there were no subsequent symptoms of malaria, the patient was kept under observation and frequent blood specimens were taken, but no parasites were found, and the differential leukocyte count was normal. This method of treating malaria is generally worth further

[1] American Journal of Tropical Diseases and Preventive Medicine, June, 1915.

study, particularly in cases which have resisted the original quinine treatment.

THE TREATMENT OF MALIGNANT MALARIA. Most of the cases of malignant malaria, or, in other words, those which are liable to prove fatal, are due to the estivo-autumnal form of the parasite. This organism spends about three-quarters of its life-cycle lodged in the capillaries, and only about one-quarter of its existence is spent in the circulating blood. Whether or not this tendency to stay in the capillaries is responsible for many of the symptoms, or not, is perhaps open to question, but it seems highly probable that this is the correct hypothesis, particularly as regards the brain symptoms. As long as the parasites are in the capillaries they are not exposed to the action of quinine, so that it is only when they segment and appear in the circulating blood that they are subjected to the action of the drug. Inasmuch as the segmentation is more or less a continuous process, in the treatment of this form of malaria it is necessary to have the quinine present in the blood almost continuously in order to effect a cure. In severe cases the disease may have gained such headway that it is impossible to stop it by quinine administered by the mouth, as the absorption proceeds so slowly. The subcutaneous or intramuscular injections of the drug usually cause very severe local reactions which hinder absorption. Bass[1] has suggested the intravenous administration in such cases, and he advises the use of not more than 10 grains of the hydrochloride at one dose, and not more than 30 grains to be administered at twenty-four-hour periods. Larger doses than this given intravenously may prove very dangerous, 20 grains given at one time are sufficient to produce sharp dizziness, nausea, and other disagreeable symptoms, and 50 grains may be fatal. He also makes a suggestion, on theoretic grounds, that the inhalation of amyl nitrite should tend to dislodge the plasmodia from the capillaries and this might be tried after the administration of the quinine.

**Malta Fever.** THE AGGLUTINATION IN THE BLOOD IN MALTA FEVER. Virgillo[2] has made a study of the agglutination reaction of this disease and determined that individuals infected with the Micrococcus melitensis show a positive reaction in a dilution of over 1 to 100. In individuals who have had the disease, the agglutination reaction may persist, but only in dilutions of 1 to 100 or 1 to 200 in the cases which were studied. He believes that this may be of some value in cases in which the past history is doubtful. Agglutination may be found in numerous individuals either normal or those suffering with other disease in dilutions of 1 to 50. For the positive diagnosis of the disease, Virgillo believes that the reaction should occur in dilutions of at least 1 to 300 and 1 to 500, and lesser dilutions giving the reaction should be regarded as doubtful.

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[1] Journal of American Medical Association, August 14, 1915.
[2] Il Policlinico Sezione Medica, May 2, 1915, p. 589.

It seems highly probable, if, in the United States, the blood of some of the long-drawn-out febrile diseases were tested for this disease it might be found to be present occasionally, particularly in individuals who have been using goat's milk. I have on one or two previous occasions called attention to cases where febrile conditions were cleared up by this means of diagnosis.

The Use of Autogenous Vaccine in Malta Fever. Owen and Newhan,[1] have reported a single instance in the case of a soldier who had returned from the Island of Malta with a febrile disease. The patient's condition not improving under the expectant treatment, it was decided to try the effect of an autogenous vaccine. This was accomplished by making the vaccine out of a culture of the Micrococcus melitensis obtained from the patient's blood. The patient was given four doses of the vaccine at intervals of about ten days, the initial dose was approximately 200,000,000 organisms. The injection of the vaccine was followed by marked improvement, the temperature gradually reaching normal. It remained so until his discharge several months later. Kennedy tried this method of treatment several years ago, using much smaller doses, but with considerable success, and Bassett-Smith, as early as 1907, suggested the use of stock vaccines in the treatment of this disease.

Measles. The Treatment of Measles with the Serum of Measles Convalescents. The subject of using the blood serum of convalescent patients in the treatment of cases of the disease is by no means new. In 1896 Weissbecker tried this method of treatment in scarlet fever, and in 1902 von Leyden, in collaboration with Huber and Blumenthal, made some observations, and more recently Reiss and Jungmann, in 1912, made further observations. As far as I know, however, this method has never been attempted in measles before the experience of Majoli.[2] In the winter and spring of the year 1914 there was in Ancona an epidemic of measles which reached its maximum in March when there were 741 cases. In the town, which has a population of 68,280, there were 1938 cases of measles, with 56 deaths. Some 58 of these cases, all of extreme gravity, were treated in the hospital, with a mortality of slightly over 25 per cent. The majority of these patients were between two and ten years of age. Majoli utilized the blood serums of the convalescents who had not been affected by the administration of medicines and who had not had any complications. Early in the convalescence, blood was drawn from the veins under the usual precautions, generally about 250 c.c. being taken and kept twenty-four hours at a low temperature. The serum was then withdrawn and bottled in containers holding from 5 to 10 c.c. This serum was tested to insure

[1] Lancet, September 4, 1915.
[2] Il Policlinico Sezione Medica, September 12, 1915, p. 1229.

its sterility and used in the treatment of some of the cases. The dose given varied with the case, and particularly the severity of the disease. From 15 to 50 c.c. were used in each case, the dose ranging from 5, 10, to 20 c.c. at a time and repeated in twenty-four hours. There were no untoward results in any of these cases. In the untreated cases of measles, the temperature lasted about a week, while in the cases which were injected in the first two or three days of the beginning of the exanthem, the fever lasted from four to five days. In all the cases injected, the eruption was particularly characteristic. It became rapidly limited, faded and was followed by a very slight desquamation. This was in direct contrast to the cases which were not injected. In none of the 8 cases treated by this method was there any complications, and each was quite in contrast to the other cases in the hospital in which there was such a heavy mortality. In view of the results obtained, Majoli believes that this method is worthy of further study.

THE EARLY DIAGNOSIS OF MEASLES. Grumann[1] has observed an early manifestation of the disease occurring before the eruption, and simultaneously with Koplik's spots. In some instances, when the Koplik spots are absent, this tonsillar manifestation may be present, and consists of punctate or linear white efflorescences in the region of the lacunar depressions and on other portions of the tonsils. The spots are more apt to be seen here, while the linear eruption is more common upon the protuberances.

**Meningococcus Arthritis.** This infection bears a very close resemblance to the primary or secondary involvements of the joints caused by the pneumococcus. These two infections of the joints are the mildest that are met with. Netter and Durand[2] have made a study of this subject and in their series of cases found that involvement of the joints was second in frequency only to otitis media. In 200 cases of cerebrospinal fever, 11 showed involvement of the joints, sometimes only one joint and at other times several being affected. In 5 cases in which the arthritis came on rather late, the organism could not be cultivated in the joint nor found in the joint fluid. In 4 cases the suppuration was in the fingers and toes, in 1 child, one year of age, there were eleven separate joints involved. The cases which persisted were treated by local injections of the antimeningitis serum which was used with very great benefit. They report one instance, in the case of a child, three months of age, in which there was a fatal primary meningococcus arthritis in the shoulder. The meninges in this were apparently perfectly normal. In all the cases that lived, the joints eventually became perfectly normal.

[1] Münchener medizinische Wochenschrift, 1914, lxi, 132.
[2] Bulletin de l'Académie de Médecine, Paris, April 13, p. 441.

**Meningitis.** The Research Laboratory of the Department of Health of New York City have made a number of valuable studies of the various infectious diseases, and among the publications from this laboratory is a summary, by Du Bois and Neal,[1] of four years of clinical and bacteriological experience with meningitis.

The cases studied were those reported by physicians; if the services of the department are desired, the case is examined, and lumbar puncture done, if permitted. In studying cases, they found that the points of differentiation, in their order of value, are, a lumbar puncture, with an examination of the fluid, the history, and the physical signs. If the fluid is clear and increased in amount, it usually indicates one of the following conditions: Tuberculous meningitis, poliomyelitis, syphilitic involvement of the central nervous system, brain tumor, or meningismus. If the fluid is cloudy, it is the result of a meningitis due to the meningococcus or some of the other pyogenic organisms.

The fluid has been studied both from a bacteriological and chemical point of view, and in some instances by inoculating guinea-pigs. Smears and cultures have also been made from the sediment, if the fluid contains any. Clear fluids have been centrifuged for one hour at a high speed, and a smear made by putting the last few drops from the tube on a slide and evaporating it to dryness in the incubator. Smears from the cloudy fluid are stained by Gram's method, and those from clear fluids with Ziehl's tubercle bacillus stain, and in some instances another preparation is made, using a capsule stain. The presence or absence of bacteria is noted, together with the number and kind of cells. The cell counts have not been made for the total number, because it has usually been some time after the withdrawal before the examination could be made, and the authors believe that it has no great advantage, inasmuch as there is nothing particularly diagnostic in the exact number of cells per cubic millimeter. In poliomyelitis, at the stage at which it is usually examined, and in tuberculous and syphilitic meningitis, the cells are considerably increased, there usually being from 20 to 30 to a field. The mononuclear elements make up about 95 per cent. of these. In cerebrospinal fever and the other cases of meningitis due to pyogenic organisms, the cells are enormously increased, so that it is not necessary to use the centrifuge. In these cases the polynuclear cells predominate, and in the specimens examined early, may make up 98 per cent. of the total. Later on, if the patient improves, the number of cells decreases, and the percentage of mononuclears increases.

The culture methods are interesting. Those showing a Streptococcus pyogenes, Streptococcus mucosus capsulatus, or a meningococcus, and those in which no organism is found, but one of these is suspected, are planted on 2 per cent. glucose ascitic agar. Those showing the influ-

[1] American Journal of Diseases of Children, January, 1915, p. 1.

enzal bacillus or a pneumococcus are planted on blood agar. If the fluid is clear, in addition to whatever cultures are made, injections are made in from 5 to 7 c.c. amounts into the groins of the guinea-pig. The pig is kept for a month, and then injected into the axilla with 1 c.c. of crude tuberculin diluted to 3 c.c. with normal salt solution. Usually, if it is tuberculous, it is dead the next morning. The final proof of tuberculosis depends on caseous inguineal glands or tubercles in the spleen, or both, at autopsy. In some instances, clear fluids that have been contaminated will produce large inguinal nodes that may even go on to caseation, but 1 c.c. of tuberculin will not kill in these cases.

The chemical tests of the fluid are used which are in ordinary use for albumin, globulin, and reduction with Fehling's solution. The nitric acid ring test is used for albumin, and they judge the amount by the depth of the ring when it is first formed. Globulin is estimated by Noguchi's test. This is made by adding one part of the fluid to 4 or 5 parts of 10 per cent. butyric acid in normal salt solution, boiling and adding about as much normal sodium hydroxid as there was fluid to begin with, and then boiling again. Care should be taken not to use too much sodium hydroxide, as it will redissolve the globulin. In normal fluids, there will be a faint opalescence, and in pathological fluids a flocculent precipitate varying in amount with the severity of the inflammation present. If the fluid shows globulin, it may be taken to mean that there is an inflammation of the meninges, and the authors believe that it is the most important of the chemical tests, because it separates fluids due to meningism and those due to a true meningeal infection. It must be borne in mind that both of the above tests are of no value if blood is present in the fluid. The majority of clear fluids examined will reduce Fehling's solution. This test is really of comparatively little value. It has been stated that it was a valuable differential point between tuberculous meningitis and poliomyelitis, inasmuch as it has been supposed that the fluids from poliomyelitis will reduce Fehling's solution, but tuberculous fluids will not. The authors studied this reaction in 88 known tuberculous fluids, and 65, or 73 per cent., gave a good reduction. They conclude that the absence of reduction is of value, while the presence of it means absolutely nothing. They had occasion to examine the fluid from a case of heat prostration, which also failed to reduce the solution. In the cloudy fluids from cases seen early, and where they were mild, reduction may be noted, and then there is a period in which it will not reduce the solution, and as the patient improves and the fluid clears, the power to cause reduction returns.

The authors have examined two fluids, and have seen a third, that illustrated the syndrome of Froin, that is, a spontaneous coagulation and a yellow color. This reaction is found in cases in which some hemorrhage has taken place. The cause of it is not understood at the present time. Two of the fluids were from poliomyelitis patients, 1

of whom recovered and 1 died, and the third from a patient with cerebrospinal fever, supposed to have had a fracture of the skull. This patient recovered.

The importance of the history and diagnosis may be stated somewhat as follows: Of course, the final diagnosis is made by the examination of the fluid, but in those in which there is a history of middle-ear disease or fracture of the skull, pyogenic organisms other than the meningococcus may be suspected. The fluids from cases of tuberculous meningitis and poliomyelitis are frequently found to give identical chemical and microscopic pictures, when the tubercle bacillus cannot be found. The history in these cases may be of considerable value, inasmuch as in poliomyelitis there is a sudden onset with a very high temperature, which falls quickly. In some instances there is a previous history of some gastro-intestinal disturbance, or some involvement of the upper respiratory tract, and some cases may show a redness of the throat. In tuberculous meningitis the onset is usually gradual, and preceded by unusual irritability. It occasionally happens, however, that in families in which children have been carefully observed, there may be a history of sudden onset, frequently with convulsions. The temperature, if it has been taken, is generally found between 99° and 101° F., sometimes it is normal or even subnormal. There are transient paralyses, projectile vomiting, and crying out at night. The authors failed to mention a point which I have found to be of great value, that is, the marked appearance of meningeal symptoms one day, and then a remission of these, sometimes almost to a normal condition, and then a recurrence of the symptoms. Sometimes there is a difference in the comatose cases. In the stuporous stage of tuberculous meningitis it is impossible to arouse the child, whereas in poliomyelitis a determined effort will frequently bring an intelligent answer, but the child immediately relapses into the comatose condition.

The differentiation between cerebrospinal fever and tuberculous meningitis is usually easy. In cerebrospinal fever the onset is usually sudden, the mental condition is comparatively good, except in the fulminating cases, the rigidity of the neck is marked, the fever is higher, and the projectile vomiting rather rare. In contrast with this, in tuberculous meningitis the onset is usually slow, with a history of irritability, then increasing stupor, from which it is impossible to arouse the child. The rigidity of the neck is apt to be slight or moderate, and is anterior or posterior, and none laterally. The fever is lower and may be normal, or even subnormal, and projectile vomiting is common. In infants the rigidity in cerebrospinal fever may be so easily overcome that one may be in doubt about it, but if the child is placed on its side the retraction is usually marked.

*Meningism* is a term which has been used to cover the condition in which there are symptoms common to meningitis, and in which the

cerebrospinal fluid is increased in amount but normal in character. Various terms have been used to describe this condition, and it has also been called circumscribed meningitis. It is quite probable that in many instances there may be a localized inflammation, but it also seems to be true, although there is no definite proof, that the symptoms may be present in which there is no circumscribed meningitis. By far the most common cause is pneumonia, and, after this, gastro-intestinal disease, whooping-cough, scarlet fever, and typhus fever may be mentioned. The other diseases in which it has been found are rarely seen, and in them it may be regarded as exceptional.

Du Bois and Neal have seen 80 cases, in which 53 recovered, 22 died, and 5 were lost sight of. The table of 74 cases is as follows:

| | |
|---|---|
| Pneumonia—uncomplicated | 39 |
| Gastro-intestinal disease | 8 |
| Whooping-cough (two patients had pneumonia also) | 6 |
| Scarlet fever (one patient had pneumonia also) | 5 |
| Typhus | 3 |
| Typhoid complicated by pneumonia | 1 |
| Measles | 1 |
| Middle-ear disease | 1 |
| Retropharyngeal abscess | 1 |
| Orbital abscess | 1 |
| Pott's disease | 1 |
| Epilepsy | 1 |
| Rachitis | 1 |
| Streptococcus osteomyelitis | 1 |
| Staphylococcus septicemia | 1 |
| Influenza | 1 |
| Nephritis | 1 |
| Heat prostration | 1 |

In most of these cases the meningeal symptoms did not progress. The authors did not see a single instance of generalized meningitis following a case of meningism, and they argue, and apparently with reason, that if the condition is due to a localized infection of the meninges, one would expect to see an occasional meningitis as the result. They were of the opinion that the condition is a functional one, probably of toxic origin. They are of the opinion that in these cases a lumbar puncture should be done, even where the diagnosis is clear, as the withdrawal of the fluid seems to hasten recovery. The fluid they believe to be more of the nature of the transudate. Their observations on this point are interesting. With certain exceptions, the cells have not been increased, and neither albumin or globulin was present, but Fehling's solution was readily reduced. All cases were negative bacteriologically, both by smear, culture, and animal inoculation.

Their exceptional cases are important. Two cases of whooping-cough, both of which died the same day the puncture was done, showed an

increase in albumin and globulin and number of cells; in 1 case about equally divided between endothelial cells and polynuclears, in the other 95 per cent. or more polynuclears. In 1 case of typhus the cells were increased 95 per cent., being mononuclears. This patient recovered.

The case of heat prostration was examined, and the fluid showed a faint increase in albumin, a slight increase in cells, 70 per cent. being polynuclears. This fluid failed to reduce Fehling's solution, and was the one fluid that did not do so readily. The patient recovered.

Plaut, Rehm, and Schottmüller have included under the term meningism cases in which the fluid showed an increase in albumin and globulin, and an increase in the number of cells, usually mononuclear, but sometimes polynuclear. Du Bois and Neal believe that these instances may be mild and recovering cases of cerebrospinal fever in which the organism has disappeared before the puncture was made. Conjunctivitis is not uncommon in cerebrospinal fever, while it is rare in the other meningeal diseases. On the other hand, ptosis and strabismus are more common in tuberculous meningitis, but may be noted in the other meningeal diseases.

Their experience with the other and less useful signs of meningitis are interesting. They do no attach much importance to Kernig's sign, as they believe it is difficult to be sure of it in young children. They place more value on Brudzinski's sign, which consists in the flexion and eversion of the legs and arms when an attempt is made to flex the head on the chest. In infants, the bulging of the fontanelle is of value. MacEwen's sign, which consists in a change from the normal percussion note over the lateral ventricle, due to an increased intraventricular pressure, may be noted, and, when it is, they have always found an increased fluid, except in cases of basal meningitis, in which the connection between the brain and cord is partially or totally cut off. This sign requires considerable practise to elicit, and for the average practitioner has little value. The variations in the regularity of weight and depth of respiration is of some value, and is commonly seen in meningitis. Cheyne-Stokes breathing may be seen late in tuberculous meningitis. The pulse is very irregular in rate and volume, and Du Bois and Neal believe that this is more apt to be so in tuberculous meningitis than in the other meningeal diseases.

Their studies of the temperature show that, as a rule, the temperature is low and long-continued in tuberculous meningitis, high, rising rapidly, and dropping quickly in poliomyelitis, and runs a very irregular course in cerebrospinal fever.

It is of exceeding interest to note their experience as regards the eruption. In 112 cases of cerebrospinal fever they found an eruption only 16 times, and in these cases there was nothing characteristic about it, either in its appearance or the time of its occurrence. This is quite in contrast to the observations of the earlier authors, in which in many

cases the disease was known as spotted fever. My own experience in this regard corresponds to theirs. Herpes is about as common in cerebrospinal fever as it is in pneumonia.

In regard to paralysis, their observations are also worthy of note. They believe that in cerebrospinal fever it is uncommon, and in 112 cases they have seen palsy twice only. They have found it common, but usually transitory, in tuberculous meningitis, and they state that it is always present in frank cases of poliomyelitis. Holt merely states that "other nervous symptoms frequently present are ankle-clonus, muscular tremor, especially of the hands, and paralysis, which may be facial, monoplegic, or hemiplegic."

Osler states, "paralysis of the trunk muscles is rare, but paralysis of the muscles of the eye and the face is not uncommon."

The *treatment* of cerebrospinal fever may be considered under three heads: The prophylaxis, specific, and general treatment. Under ordinary circumstances cerebrospinal fever is not very contagious, but it becomes so at times. For this reason it is considered best to quarantine patients ill with the disease, and those in contact with them, who show meningococci in cultures from the nose and throat. The question of dealing with carriers is more or less difficult, inasmuch as it requires considerable skill in bacteriological technic to isolate the meningococci from nose and throat cultures when they are few in numbers, and in times of epidemics there are usually an insufficient number of laboratory workers with the proper amount of experience to handle and examine the large number of cultures that are taken. Du Bois and Neal believe that the most satisfactory method of dealing with carriers is to swab out the nose and throat two or three times daily with argyrol solution, and they hope to make a subsequent report upon their work along this line.

Their method of treatment is to do a lumbar puncture with the patient lying on the side with the knees drawn up against the abdomen, with the neck bent and the back well arched, so that the intervertebral spaces will be as great as possible. They never use the sitting posture. The skin is painted with iodine over an area of about four square inches around the site of puncture, and a sterile or bichloride towel is laid over the hips through which to find the landmarks. They have had no secondary infections of the cord, although occasionally the skin has become infected in small children through soiled napkins. They use a Quincke needle, size 18 or 19, then go in the midline through the notch most nearly coinciding with a line drawn from the crest to crest of the ilium. They use a piece of rubber tubing about fifteen inches long attached to a metal connection that fits in the end of the needle when the stylet is withdrawn, and to the other end of the rubber tubing is attached the barrel of a syringe. A short piece of glass tubing is generally inserted in the tubing near the metal connection, so that the movements

of the fluid may be observed. This permits of regulating the outflow of the fluid by raising and lowering the glass container. If the fluid is cloudy, the antimeningitis serum is injected without waiting to make an exact diagnosis as to what organism is present. The subsequent treatment will, of course, depend upon examination of the cerebrospinal fluid. It is interesting to note that they have used streptococcus and pneumococcus serums in appropriate cases, and, while they have had no cases of their own of pneumococcus meningitis to recover, they note the fact that they know of 2 that did. One patient with Streptococcus meningitis out of 15 recovered. They have had no cases of influenzal meningitis to recover.

The serum injected is warmed to the body temperature, and the gravity method is used. Their dose varied from 3 to 20 c.c. for infants and children, to from 20 to 40 c.c. for adults. The amount injected depends as much on the amount of fluid withdrawn as on the age. They believe that it is better to inject 5 or 10 c.c. less than the amount of fluid withdrawn. They record a number of cases of dry taps in the course of cases of meningococcus meningitis. In these cases they found the serum ran in freely and showed the usual variation in movement depending on respiration, and they believe that in such cases one should proceed very slowly and with unusual care. It is possible that following the period of exudation there is one of lessened secretion, and this is followed again by increased exudation, as a dry tap is frequently followed by one in which fluid is obtained. Where the exudate is thick, and will not flow through the needle, gentle suction with a syringe may be tried, and if that fails, a little serum injected will sometimes start the flow. In severe cases they have repeated the dose every twelve hours until there is improvement, but in moderate and mild cases it is given daily for the first four days, and the further administration depending largely on the patient's general conditions and the bacteriological examination of the fluid. They believe they get better results if the patient is turned from side to side, so that no two successive punctures are done with the patient lying on the same side. They have had a number of cases in which, following the injection, or during it, the patient has showed marked symptoms of shock. If the needle is still in place, a small amount of the serum may be withdrawn, and, if breathing stops, artificial respiration may be resorted to. They believe it to be much less frequent with the smaller doses. They think that the symptoms of shock are due to injecting too large doses, or using the serum too rapidly, or possibly, in some instances, to unusual susceptibility on the part of the patient.

The serum that they have used lately has contained 0.2 per cent. tricresol. In their earlier work it contained 0.3 per cent., but inasmuch as the tricresol has been blamed by some for the untoward results following the injection of the serum, they reduced the amount. They

believe the fear of tricresol is unfounded, inasmuch as in France, where serum without preservatives is used, cases of shock and occasional fatal results are reported. They have not used the blood-pressure apparatus in all their cases, owing to lack of sufficient assistance to manage it, so they have made no comment upon this method, beyond to state that it is probably a help to those who have had little experience.

In addition to this, they have used hexamethylenamin in all their cases of acute meningeal infections. The patient should be kept in a quiet, darkened room, and sedatives used if necessary, and it is very necessary to see that the bowels are emptied and that retention of urine does not occur. The patient should be examined for a distended bladder daily. These patients are particularly prone to pneumonia, and they believe that they should be carefully protected from draughts and kept warmly covered, particularly during and after a lumbar puncture.

They have had basal meningitis in 6 cases, all of which were fatal.

Outbreaks of this *disease in the British camp* led to a large number of contributions on this subject in the British journals, most of which added nothing to what we already know about the disease. Osler,[1] however, has contributed one of his characteristically interesting articles dealing with the subject of the disease as it occurs in camps and barracks. There have been wide-spread epidemics from the beginning of the nineteenth century, and these have occurred in most countries, although the British Isles have been singularly free from the disease, and such outbreaks as have occurred have been unimportant, until 1907, when there were some 1000 cases in Glasgow, with 595 deaths, and in Belfast, where there were 725 cases, with 548 deaths. In the latter city these cases extended over a period of eighteen months. The epidemics seem to occur in waves, five such groups of epidemics having occurred since 1805, the present one dating from about 1893. The spread of the disease is a matter of great interest, as it occurs in certain centres, disappears, and turns up in another part of the country, and in many instances the epidemics are very circumscribed.

The organism that causes the disease was first described by Weichselbaum, and since then has been very thoroughly studied, but perhaps not sufficient attention has been paid to the different strains of the organism. The organisms are found in the cerebrospinal fluid, in the blood and the joints, and the visceral regions, and in the secretions of the nasal pharynx. They may also be found in persons coming in contact with the sick, and it is thought that the intensity of epidemics bears some relation to the number of carriers. As a rule, the meningococcus disappears from the nasal pharynx of healthy persons in the course of a few weeks, but it has been found, however, in the nasal pharynx of persons who have not been exposed to infection, as in a study made

[1] British Medical Journal, January 30, 1915, p. 189.

## Characteristics of the Various Fluids.

| Meningeal condition. | Pressure. | Amount c.c. | Appearance. | Cytology. | Bacteriology. | Albumin. | Globulin. | Fehling's solution. | Animal inoculation. |
|---|---|---|---|---|---|---|---|---|---|
| Normal | Normal | 5 to 10 | Clear | Very few cells | Sterile | ± | ± | + | Negative. |
| Meningismus | Increased | 10 to 100 | Clear | Very few cells | Sterile | ± | ± | + | Negative. |
| Poliomyelitis | Increased | 20 to 100 | Clear; sometimes slight fibrin web | Early poly-nucleosis; later lymphocytosis up to 95 per cent.; endothelial cells | Sterile | +-++ | +-++ | + | Negative. |
| Tuberculous meningitis | Increased | 30 to 120 | Clear fibrin web | Lymphocytosis up to 95 per cent. | Tubercle bacilli | ++-+++ | ++-+++ | - in 25 per cent. | Tuberculosis in four weeks. |
| Epidemic cerebrospinal meningitis | Increased | 5 to 120 | Cloudy | Polynucleosis up to 98 per cent. | Meningococcus | ++-+++++ | ++-+++++ | + or - according to severity and stage | |
| Meningitis due to other organisms | Increased | 20 to 100 | Cloudy | Polynucleosis up to 98 per cent. | Infecting organism | ++-+++++ | ++-+++++ | - may be + early | |

in the Munich garrison, where 158 soldiers out of 9111 showed the presence of the organism.

Sophian and Black have attempted vaccinations on a small scale, as I have previously noted. Jaeger[1] made an exhaustive study of the disease as it affects soldiers. In France there have been 62 epidemics, of which 43, or 69 per cent., were confined to the troops. In Germany there have been a large number of small epidemics in garrisons, chiefly in southern Germany. In Italy most of the disease has occurred among soldiers. Since 1870 the disease has increased in the European armies, but the epidemics have been small, usually restricted to a single town, and sometimes to a single barrack. In the British Isles the disease has not occurred in the army, with one or two trifling exceptions of a few cases each. The outbreak in 1914–1915 consisted of a very limited number of cases.

Curiously enough, the disease does not seem to have prevailed in the great campaigns of the nineteenth century. There is no reference to it in the Napoleonic or Crimean, the Italian or the Danish Wars. In the Franco-Prussian War there was a few cases which occurred about Paris. In the Russo-Japanese War there were a few isolated cases, and the same is true of the South African War. In the Civil War in the United States there were outbreaks in both armies during the first three years of the war, but the epidemics were not very wide-spread, and compared to the typhoid, dysentery, and malaria, were not of much importance.

Among the particularly valuable reference works may be mentioned the monograph of Stillé, 1867, which contains a very full account of the symptoms, and an account of various epidemics in Hirsch's *Geographical Pathology*, and more recently Sophian's monograph, *Epidemic Cerebrospinal Meningitis*, 1913, and Heiman and Feldstein's *Meningococcus Meningitis*.

THE PLACE OF THE MENINGOCOCCUS IN THE ETIOLOGY OF CEREBROSPINAL FEVER. We become so accustomed to consider Weichselbaum's organism as the cause of cerebrospinal fever that any other view seems at first a little startling. It is an evidence, however, of a good scientific spirit to question any opinion about which there can be any doubt. Hort, Lakin, and Benians[2] have published two notes on some bacteriological studies made during the recent small epidemic of cerebrospinal fever that occurred among some of the troops.

They sum up the evidence for and against the belief in the specificity of the meningococcus as follows: The view that the meningococcus is the primary agent is based on:

1. The frequency with which the organism can be isolated from the nasopharynx, cerebrospinal fluid, and blood in acute cases of the disease, and from the meninges and other tissues postmortem.

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[1] Die Cerebrospinal Meningitis aus Heeresseuche, Berlin, 1901.
[2] British Medical Journal, March 27, 1915, p. 541; and April 24, 1915, p. 715.

2. Its frequent isolation from the nasopharynx of primary and secondary contact carriers.

3. In some ascertained carriers the disease subsequently develops with typical meningococci in the cerebrospinal fluid or elsewhere.

4. Its presence in the nasopharynx of carriers acting as a theoretical bridge from one epidemic to the next.

5. Meningitis can be produced in monkeys after the exposure of the arachnoid and the injection of living cultures of the organism, or by direct inoculation into the spinal canal.

6. The injection of antiserums produced by injection of cultures of the meningococcus is sometimes followed by a cure.

7. Emulsions of the organism can be agglutinated by the serum of a patient suffering from the disease.

Before taking up the study of their own observations, they have set down certain facts which they believe to show that the meningococcus, as we know it in artificial culture, may not be the cause of the disease, however much it may prove to be responsible for the more or less terminal event of meningitis.

1. The attendants on acute cases of the disease rarely contract it, although the percentage of such acute cases harboring the organism in the first few days is very high.

2. For every case of the disease there are 10 to 50 carriers, but of detained carriers of the meningococcus in the nasopharynx, only a few develop cerebrospinal fever.

3. Injections of cultures of the meningococcus into monkeys, elsewhere than into the meninges or spinal canal, does not reproduce the disease or meningitis.

4. Agglutination reactions with serum from cerebrospinal cases are often unsatisfactory, both at 37° C. and at 55° C., both with autogenous and heterogenous emulsions.

5. The marked instability of the organism in the laboratory, both culturally and biochemically.

They further suggest that there are evidences that the antimeningococcus serum is not always attended with favorable results, a fact which may be explained by the organism occurring in different strains and to disease due to the parameningococcus. They also state that we have no accurate knowledge as to the effect of similar series of cases treated only by lumbar puncture, or by the injection of normal serum. They studied a number of cases from the standpoint of the blood, cerebrospinal fluid, and urine, and frequently isolated an organism which they identified as the so-called meningococcus of Jaeger. This organism was at one time believed to be identical with the one described by Weichselbaum, but has certain differences.

Their particular interest centred in the study of cathetered specimens of urine, and from a severe case they obtained a slight growth, a single

colony of which was composed of a number of different morphological types, including the meningococcus of Jaeger, the meningococcus of Weichselbaum, a Gram-negative, rod-shaped granulating organism, each granule consisting of a pair of cocci, with flattened opposed surfaces, which for the convenience of reference they have spoken of as the "biscuit bacillus," and in addition to these, various Gram-positive forms. They also found in stained preparations from deposits of fresh cathetered urine from acute cases, Gram-negative cocci lying free in pairs and tetrads, and morphologically indistinguishable from the meningococcus of Weichselbaum, also clusters of much smaller Gram-negative diplococci, minute enlarged Gram-negative bacilli, and various Gram-positive forms.

These observations suggested that the meningococcus might prove to be merely a late non-infective phase in the life history of the true infective agent, and that for reproduction of the disease this must be present in its earliest forms. They have made a large number of experiments, and found that on filtering the blood, the cerebrospinal fluid, urine, and nasopharyngeal secretion of acute cases, the cultures made from the fluid passing through the filter showed colonies containing the various forms mentioned above, but attempts to isolate individual types by the method of dilution failed. They believed that they have produced sufficient evidence to justify a further study of cerebrospinal fever with reference to the presence or absence of a filter-passing organism in the body fluids of acute and subacute cases, and to study the relationship of this organism, if it is present, to the disease, as well as its relationship to the meningococcus of Weichselbaum, and to the various types of organism that they have isolated from the body fluids.

THE TREATMENT OF CEREBROSPINAL FEVER BY ANTIMENINGOCOCCUS SERUM COMBINED WITH AUTOGENOUS VACCINE. Collins[1] has suggested that, in addition to the use of the antimeningococcus serum, an autogenous vaccine be made and injected at the same time.

PHENOL IN MENINGITIS. It seems strange that more attempts have not been made to treat meningitis by means of one or the other of the suggestions of Bacelli which were made, one for the treatment of tetanus and the other for the treatment of systemic infections. The first, as is well known, consists of injections of phenol, and the second of mercuric preparations, usually mercuric bichloride. Bellotti[2] has used the phenol method in 2 cases of acute cerebral meningitis. Both patients were apparently in a more or less hopeless conditions. The drug was given in connection with a small amount of morphine, and was repeated during the day whenever the fever began to go up or the pains to increase. There were no symptoms of phenol poisoning, and, all

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[1] British Medical Journal, February 13, 1915, p. 287.
[2] Gazzetta degli Ospedali e delle Cliniche, Milan, August 23, 1915, p. 881.

told, 0.75 gram was administered. The children showed marked improvement after the first few injections, and by the twentieth day they were both convalescent and made otherwise uninterrupted recoveries.

THE MENINGOCOCCUS IN THE LUNG. We ordinarily regard the meningococcus as an organism that limits its activity to the central nervous system. As early as 1905 von Lingelsheim studied an epidemic of cerebrospinal fever in upper Silesia, and found that in the majority of cases the organism was found only in the nervous system, but in exceptional instances he could find it in the blood, in the spleen, in the lungs, and from the various serous surfaces. Since his time there have been numerous studies made upon the meningococcus, and there have been instances reported in which the meningococcus was found localized in other tissues, and without affecting the meninges. In the course of cerebrospinal fever, it is frequently noted in various parts of the body. In the infection of the lungs, this organism has been studied by Loygué.[1] He reports one instance of a woman with cerebrospinal fever, in whom the diagnosis was confirmed by a study of the organism, and who, three or four days after her entrance to the hospital, was taken with a pain in the left side of the chest. This was attended with cough and a reddish-brown expectoration, and it was thought she was suffering with an ordinary lobar pneumonia. An examination of the sputum, however, showed that there were two organisms present, one a diplococcus, corresponding to the meningococcus in appearance and reactions, and with this was a lanceolate incapsulated Gram-positive diplococcus, which was not present in any very great quantities. This organism gave the agglutination reaction of meningococcus, and there seems little doubt that this was an instance of invasion of the lung by this organism. In this instance it was not possible to recover the germ from the mucous membrane of the nose and throat.

**Myiasis of the Urinary Passages.** Cases of this kind always attract a considerable amount of attention, and are probably very rare, as Lelean[2] was only able to collect 30 cases, the earliest of which was reported by Ambroise Paré in 1582.

In a general way the larvæ from many flies have been found, most usually those from the Fannia scalaris. It is a small fly, most common in springtime, seen darting about under chandeliers. This fly lays its eggs in dark, moist places, and the larvæ may appear in from one to eighteen hours, depending upon the amount of warmth present.

Chevrel, in 1901, in reporting a case of his own, studied the literature, and concluded that there were only 20 cases reported, 6 of which he regards as authentic, 10 probable, and 4 doubtful.

[1] Paris Médicale, August 1, 1914; Il Policlinico, Sezione pratica, January 3, 1915, p. 21.
[2] British Medical Journal, 1914, i, 245.

King[1] has reported an instance occurring in a man, aged thirty-two years, who passed, with the urine, the larvæ, which was identified as the Fannia scalaris. The infection of the bladder evidently occurred through using urethral injections, using the syringe in a glass which had been kept in a shed. In this instance the larvæ had evidently penetrated the prostatic urethra, but the cystoscopic findings were negative. In most instances the eggs are deposited in the urethra, and the young larvæ pass into the bladder in search of food.

**Mumps.** A PROTECTIVE THERAPY FOR MUMPS. In a number of infectious diseases attempts have been made to use blood from a convalescent or recovered patients either as an agent in combating the disease or in preventing it. Thus, McKenzie and Martin have used a blood serum from patients who had recovered from cerebrospinal fever. Reiss and Jungman, and others, have experimented with the blood from scarlet fever convalescents in the treatment of the severe toxic cases of the disease and claim to have obtained some definite results. Flexner and Lewis have called attention to the fact that blood serum from either monkeys or human beings who have recovered from poliomyelitis will prevent the paralysis in monkeys after intracerebral injections of the virus, and Netter has used the serum from recovered patients for the treatment of the disease by intraspinal injection.

Comparatively little work has been done on the subject of mumps, but recently Hess[2] has made a report on some studies in the immunity of this disease, made at the Hebrew Infant Asylum in New York. During the winter of 1912–13 there was an epidemic of mumps in the institution which included 100 cases. During the winter of 1914–15 there was a similar epidemic of 80 cases. None of the children who had the disease in the first epidemic were affected in the second, and an attempt was made to immunize children with the blood of convalescent patients. Many of the children in the asylum had more or less complete histories as to previous diseases, and 20 who had not had mumps were selected. These were inoculated with the blood from children convalescing from the disease, using 6 or 8 c.c. of the blood drawn from the vein at the elbow of the donor and injecting it intramuscularly. These children were divided into three groups. Those of the first group were inoculated with the blood of the patients who had just recovered and in whom was still some swelling of the parotid. A second group was inoculated with blood from patients about ten days recovered from the disease, and the third group from children who had had the disease several years previous. The injections were made when the epidemic had reached a considerable height and all of the children inoculated were exposed to the disease. Not one of the inoculated children contracted

[1] Journal of American Medical Association, December 26, 1914, p. 2285.
[2] Pediatrics, May, 1915, p. 230; Amer. Jour. Dis. of Children, April 1915, p. 99.

it, although other children in the same wards did. There were no local or consitutional reactions. Care was taken to avoid syphilis, and presumably tests were made to determine whether hemolysis would occur, although this is not stated.

**Oroya Fever.** Two years ago, Strong, Tyzzer, and Sellards reported their observations on the subject of oroya fever and its relation to verruga peruviana. These two diseases have been confused, as they were able to demonstrate, and not only has there been this confusion, but also with malaria and paratyphoid fever.

In a second contribution,[1] they have given a review of their subsequent studies, made chiefly in the large hospitals at Lima, and in some of the mountain towns of the interior.

Oroya fever, or Carrion's disease, as it is often called, occurs in many of the deep, narrow valleys of the western slope of the Andes, generally in the altitudes of from 2500 to 8000 feet. In these same regions the other diseases mentioned above are also found and usually confounded, and as the confusion exists in Peru, it is not improbable that the disease is also overlooked in other countries. The parasite of the disease is difficult to detect, as is pointed out in the first study. The disease seems to have a marked seasonal prevalence, occurring in Peru from January to April, and particularly toward the close of the warm, rainy season. According to the hospital reports in Lima, most of the cases were admitted in January, February, and March, and in April and May there were no admissions with the diagnosis of this disease at one of the larger hospitals. Verruga, on the other hand, is not uncommon during these months. This difference in season of these diseases was noted in 1898 by Odriozola.

The clinical features of the disease consist chiefly in a fever, which is usually irregular, and in the severer cases by a rapid and pernicious form of anemia, which results in extreme prostration, and frequently in death. In the worst cases the patient may not live longer than three or four weeks from the onset.

The previous descriptions of the disease have included combinations of this rather acute fever and of the more chronic disease with an eruption, or verruga, and this confusion has been furthered by both infections occurring at the same time in the same patient, just as verruga and malaria may occur together. This fact has led to a great amount of confusion, which the Harvard Commission has attempted to straighten out.

The disease has also been confused with paratyphoid, and the physicians who studied these diseases have isolated paratyphoid bacilli from the blood of the supposed cases of oroya fever. It is possible that the two diseases may occur at the same time, and it is also highly probable

[1] Journal of American Medical Association, March 6, 1915, p. 806.

that some mistakes in diagnosis have been made. The Harvard Commission, from studying uncomplicated cases, and also reports in the literature, have reached the following conclusions regarding the chief clinical features: The incubation period is about twenty days, although this has not been sufficiently verified. The disease begins with malaise, pains and weakness in the limbs, and indisposition. Following these symptoms, there are slight chills and fever. The fever and chills usually increase in severity as the disease develops. The fever is often very irregular, generally remittent, but sometimes intermittent. It usually fluctuates between 100.4 and 101.3 F., and rarely rising to 104° F. Accompanying this fever is a rapid, pernicious anemia, which may or may not be complicated by hemorrhage, vertigo, and fainting spells. The skin becomes pale, the mucous membranes are waxy in appearance, there may be murmurs over the heart and large vessels, and edema of the lungs and about the joints. The tongue is coated, and the bowels frequently constipated in the early stages, and later diarrhea frequently develops. The urine is scanty, and the specific gravity high, and there is occasional albuminuria. As the disease progresses, the prostration increases, and there is restlessness, insomnia, and sometimes delirium. In uncomplicated cases there is no eruption on the skin. The spleen is frequently enlarged, but not always palpable, and the liver may be slightly enlarged, and the lymph nodes are usually more or less swollen. In some instances there is pain in the long bones, and some observers report that pain in the joints is a common symptom, although this was not noted in the cases studied by Strong. The most striking and characteristic feature of the disease is the change found in the blood. In some instances the anemia may be very rapid, and in one instance the red cells had decreased to less than 1,000,000 per cubic millimeter, in a case which terminated fatally in twenty-eight days. Nucleated red cells appear early in the peripheral circulation, and rapidly increase in number. These consist chiefly of normoblasts, but megaloblasts are also noted. There is marked polychromatophilia and poikilocytosis. Instances are on record in which the normoblasts were present to the number of 2000 per cubic millimeter, and megaloblasts 200, and in 1 case the normoblasts reached 15,300, and the megaloblasts 3420. There was a moderate leukocytosis present, and the differential counts are essentially normal. The hemoglobin in severe infections may fall to as low as 15 per cent., and 40 to 50 per cent. is frequently noted.

Most of the cases of the disease are severe and frequently terminate in death, but mild cases of the disease are met with. When there is a fatal outcome, it usually occurs within a few weeks of the onset, and apparently from exhaustion. In the patients who recover, or when there have been symptoms of the disease, the convalescence generally begins within twenty-five or thirty days of the onset. The mortality varies, perhaps, in different epidemics, some observers placing it as high

as 75 per cent., and Rocha-Lima states that it may reach 98 per cent. Strong and his associates believe it varies between 30 and 40 per cent.

THE PATHOLOGY OF OROYA FEVER. There have been very few reports made upon the pathological anatomy of oroya fever, and apparently but very few autopsies have been done in the countries in which the disease is most frequently encountered. There are a few references to the lesions in the books on tropical medicines, such as the publications of Scheube, Plehn, and Castellani. The most complete published account is in the monograph of Odriozola.[1] He described the anemia, and noted the fact that local complications of an inflammatory nature were not uncommon, particularly at the bases of the lungs. He also noted the occasional occurrence of congestion of the intestinal mucosa, sometimes of the enteritis. The liver and spleen are congested, and the liver is often very much enlarged. The spleen may also be hypertrophied, but may become rapidly reduced in size. There are great irregularities in the size of both organs. The enlargement of the liver, however, being apparently more constant than that of the spleen, there is a general enlargement and congestion of the lymph nodes, and the mesenteric nodes may be so large as to suggest tuberculosis or leukemia.

Strong and Tyzzer have reported the results of their studies made in Lima on the material in the museums, and also from tissues collected by themselves. The principal points in their article are as follows:

The anemia is the most striking feature, the pallor being very marked, the skin usually a pale, yellowish, waxy color. In uncomplicated cases there is no eruption upon the skin, but diffuse and punctate hemorrhages may occur in the conjunctiva and the mucous membranes of the nose and mouth. The superficial lymph nodes are usually moderately enlarged, of firm consistence, and pale pink on section. Emaciation is usually marked, and there is very little remaining subcutaneous fat. There may be small petechial hemorrhages throughout the body, and there is a tendency to moderate edema in many of the tissues. The lungs sometimes show congestion, more particularly at the base; sometimes there is edema. They noted that the spleen is usually enlarged, with firm consistence, and infarcts are common. The liver is usually enlarged, flabby, and shows areas in which necrosis and fatty degeneration are perceptible. The mesenteric lymph nodes are enlarged, the follicles of the small intestine may be swollen, and in other cases they may be normal in appearance. In some instances superficial ulcerations are found in the large intestine, the bone-marrow is usually distinctly softer than normal, and the surface sometimes shows a grayish-red mottling.

[1] La maladie de Carrion ou la verruga péruvienne, Paris, 1898, p. 98, Carré and Naud, editors.

The *histological findings* of oroya fever are probably accurately described for the first time, inasmuch as most of the studies made in Peru were done on cases which were evidently verruga. The tissues used were obtained by Strong and Tyzzer from cases which they had observed, or from specimens furnished them in Lima.

There are marked changes in the liver, spleen, bone-marrow, and lymph nodes. In the liver there are areas of degeneration which look as if they had been caused by some toxic material, inasmuch as there are extensive areas of necrosis of the central type, beginning about the hepatic veins. In these areas, in freshly cut specimens, fat droplets may be demonstrated, while in the older specimens the tissues show numerous vacuoles, representing the place formerly occupied by the fat. There is a moderate amount of pigmentation, much of which is seen in the endothelial phagocytes, and in a few of the endothelial cells lining the sinusoids. Most of this pigment does not give the iron reaction, and it is yellowish or brownish, and not black.

The spleen shows numerous infarctions, and many of the veins show thrombosis, and, at the periphery of many of the splenic nodules, there are areas of necrosis in which there is a marked deposition of fibrin. There is a large amount of pigment in the spleen, which occurs in small or larger masses, and also in fine granules. This pigment is yellowish or yellowish-brown, and not black. The bone-marrow also shows evidence that some toxic substance has injured the cells.

The lymph nodes are swollen and in various stages of degeneration, and it is evident that the development of the Bartonella bacilliformis takes place. Many of the cells are distended and rounded and rod-shaped elements. There are ulcerations found in the large intestine, with distinct undermining of the mucosa at the edges, so that the lesion often has the appearance of a small abscess. No amebas or other animal parasites can be demonstrated.

**Paracholera.** We have become accustomed to hearing considerable about paratyphoid and parameningitis and now comes Castellani,[1] with the statement that he has demonstrated a vibrio from cases that resembled cholera. .The organism was found in 2 cases and also in the water of a well near which several cases of cholera-like disease had occurred. This organism he has called the Vibrio kegallensis from the name of the town in which it was found. This vibrio differs in some particulars from the vibrio of cholera, but in a general way resembles it very closely. It is apparently not pathogenic for the lower animals. It is agglutinated by the serum from cases of paracholera, but is not by the true cholera serum.

**Pellagra.** PREVENTION OF PELLAGRA. For the past several years a considerable amount of attention has been paid to the question of the

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[1] Journal of Tropical Medicine and Hygiene, April 15, 1915, p. 85.

etiology of pellagra. The idea that it was caused by a parasite of some kind had gained considerable ground, and it seemed highly probable that, if this was true, the disease was transmitted by some insect and most of the evidence brought forward laid the blame on a species of similum as suggested by Sambon. The observations to which I have already referred in previous numbers of PROGRESSIVE MEDICINE did not lead to an elucidation of this problem, but it now seems that the dietetic theory of the disease is correct. Goldberger, Waring, and Willetts[1] have given the results of some of their studies in the diet and its relation to this disease at two orphanages in the South. Both of these places have been endemic foci of the disease. The hygienic sanitary conditions have remained unchanged, the only difference being the modification of the diet, the change being to introduce fresher animal food and additional protein by adding various legumes. In one of the institutions there was no seasonal recurrence of the disease and no new cases in inmates who had been under observation for not less than one year. In a second institution there had been a single case in which there was a recurrence and there have been no new cases. Similar observations were carried out at the Georgia State Sanitarium with similar results. Sydenstricker,[2] believes that there is a possible relationship between the prevalence of pellagra and the rise in the cost of food. He says that, in the poorer American families of the white race, when a change in the dietary is made to save money they will first sacrifice the animal protein foods as being the most expensive. The families of wage-earners in the Southern States, particularly cotton-mill families, live on a lower basis than that of wage-earners' families in other sections of the country. The factors which have tended to restrict the protein food in Southern industrial communities does not seem to have acted in restricting the supply of carbohydrates and fats.

Of most interest is the brief report of Goldberger and Wheeler[3] who recount briefly the results of an experiment planned to show the possibility of producing pellagra in the healthy human, white, adult male by a restricted, one-sided carbohydrate (cereal) diet. The experiment was carried out at the farm of the Mississippi State Penitentiary about eight miles east of Jackson, Mississippi. This is a large farm in the centre of which is a small community including buildings for the prisoners, cottages for the officials, hospitals, stables, etc. There has been no history of the occurrence of pellagra at any time on this farm. From 70 to 80 convicts, all white males quartered on the place, including 12 who accepted the offer of a pardon made to them by the Governor with the assurance of proper care and treatment should

[1] Public Health Reports, October 22, 1915, p. 3117.
[2] Ibid., p. 3132.           [3] Ibid., November 12, 1915, p. 3336.

such be needed. The squad was organized early in February, 1915. In July, 1 of the volunteers was released because of the development of a prostatitis. This left 11 between twenty-four to fifty years of age who have been on a test diet up to October 31, 1915, when the experiment was ended. The men were housed in a small, screened, one-story cottage and from the time of its organization this squad was strictly segregated and under guard day and night. From February 4 to April 19, these men were kept under observation without any change in their diet. Having detected no evidence of pellagra during this period and having established the desired routine and discipline, the diet was changed. It consisted of a bill of fare in the form of biscuits, fried mush, grits and brown gravy, syrup, coffee with sugar, corn bread. cabbage, sweet potatoes, rice and collards. These articles made up the dietary, the total having a caloric value of 2,952 calories per man per day. No vegetable fats entered into the diet. The character of the cereals was the very best obtainable. The men were at work, such as whitewashing fences and buildings and working in the saw mills, with four and a half days' work and two and a half days' rest. The work of the other prisoners and the general hygienic control was decidedly in favor of the volunteer squad. Of the 11 volunteers, 6 developed symptoms including a typical dermatitis which justified a diagnosis of pellagra. The nervous and gastro-intestinal symptoms were mild but distinct. The first was noted between September 12 and 24, about five months after the beginning of the restricted diet. In all cases the skin lesions were first recognized on the scrotum. Later, there appeared lesions on the back of the hands in 2 cases and on the back of the neck in 1 case. The scrotal lesions were of the type described and figured by Merk, and the observers suggest that this scrotal involvement is probably a more common early skin manifestation than has heretofore been believed. It would probably have escaped attention but for the fact that the members of the squad were carefully examined as a matter of routine. No other cases of pellagra were observed in any of the other prisoners.

**Poliomyelitis.** Since 1907 this disease has attracted a very considerable amount of attention in this country and abroad, and I have previously noted the results from many studies. One of the best of the recent contributions is a piece of work by Lovett,[1] of Boston, based on the Vermont epidemic of 1914. He was asked to superintend the treatment of the cases paralyzed in this epidemic, and all the cases seen were charted, the tabulation showing the muscles affected, treatment, and other information. These cases are to be restudied from time to time, and the new records will be compared to the old, and this should furnish very valuable data regarding the use of various forms of treat-

[1] Bulletin of Medical and Chirurgical Faculty of Maryland, June, 1915, p. 169.

ment. Certain of the facts observed have been made the subject of his paper, which is well worth careful consideration.

The epidemic of the summer of 1914 was confined almost wholly to the northern part of the State. Two hundred and ninety-three cases were reported to the State Board of Health. It is interesting to note the fact that the first large epidemic in this country was reported in the southern part of Vermont by Caverly in 1894. His report included 132 cases. Since that time there have been no serious epidemics in the State, but beginning with 1910, the cases were apparently more numerous. At the clinics arranged by Lovett, 235 patients applied for examination, but some of these were the results of previous years or other forms of paralysis, and the result was a total of 149 cases due to the epidemic of 1914. The youngest case was a nursing baby six weeks of age, at the time of the onset, and the oldest was forty-one years of age. In this epidemic there was a particularly high incidence among older persons, 38 cases occurring between ten and twenty, and 6 between twenty and thirty, and 2 between thirty and forty years. The epidemic was one of extreme severity, the mortality being somewhere in the neighborhood of 17 per cent.

There were some interesting instances which illustrate the difficulties which may attend the diagnosis. One boy with a fractured elbow, while the arm was in the splint, had an attack of fever with increased pain. When the splint was removed there was complete paralysis from the shoulder down, which was found to be a typical case of poliomyelitis. Another case of congenital deformity of the foot had a history of always having been lame, but after an attack of fever became much lamer. The case was found to show a mixture of congenital deformity and recent paralysis. Two paralyzed children in one family were brought to the clinic, one with a typical cerebral hemoplegia of two or three years' duration, the other with a typical poliomyelitis paralysis of an arm and a leg. At the same time Lovett noted in his work in the Children's Hospital a child with a congenital dislocation of the hip in one leg, and an infantile paralysis in the other, and also a case of a child with an obstetrical paralysis of the arm on the right side, and a subsequent poliomyelitic paralysis of the leg on the same side. Some years ago Lovett and Lucas published a statement that in general the severity of the attack corresponded to the intensity of the paralysis. An attempt was made to corroborate this statement, but inasmuch as the parents all regarded their child's case as very serious, the information obtained was not of much value.

In the cases studied, the patients were stripped, and the muscles tested individually as to function. Cases too young to be studied in this way were not included in the report. The muscles were placed in three classes, wholly paralyzed, partly paralyzed, and normal. In the cases put down as wholly paralyzed, no response could be elicited from a

voluntary attempt to contract the muscle, either in a contraction of the muscular fibers or a tightening of the tendon. If the muscle had fair, but not normal, power, or if any degree of contractile power in the muscle attended could be detected, it was classed as partially paralyzed. Partial paralysis was found to be much more common than total. Out of a total of 1452 muscles affected, 416 were totally paralyzed, and 1036 partly, a ratio of 1 to 2.5. In a number of instances part of the muscle was paralyzed, and the other part not, as in the deltoid, where the anterior or posterior half might work independently. It was also noted in the pectoralis major. The reason for the predominance of partial over total paralysis seems to lie in the grouping or relation of the nerve cells in the anterior horns of the cord. These cells lie in longitudinal groups, which are largest in the cervical and lumbar regions. Each anterior route contains fibers from several groups of cells, and these fibers are distributed among several peripheral nerve trunks. Lesions in the anterior nerve route, or in parts of the groups of nerve cells, unless very extensive, will merely weaken, but not completely paralyze the muscle. The toxin of poliomyelitis very probably reaches the cord through the circulation, chiefly from the branches of the anterior spinal artery, which enter horizontally at different levels. The planes of destruction are likely to be transverse, while the lines of nerve centre association are longitudinal, so that a muscle which derives its nerve supply from a group of nerve cells occupying several segments, would have some power remaining, as a transverse lesion might easily leave some of the centres intact.

The tabulation of the *muscles affected* shows that paralysis of the leg muscle is more frequent than those of the arm, and that the quadriceps, gluteals, and gastrocnemius are most often affected. The abdominal muscles are affected in more than half of the cases, and the spinal muscles in more than a quarter. In almost every instance the abdominal paralysis was symmetrical, and sometimes it is the only part paralyzed. When other muscles were associated, it was always the leg muscles. The tibialis anticus and the gastrocnemius are the only leg muscles which have been found to be affected by themselves, that is, without paralysis occurring elsewhere in the body. In the arm, the deltoid is found to be the only muscle so affected. In the arm, it was found that the paralysis was most frequent at the shoulder, and diminished in frequency from the shoulder to the hand, and that it was severest in the shoulder, and diminished as one went toward the hand. (By severest is meant that the per cent. of total cases was largest.) The left arm was more frequently paralyzed than the right. In the legs, the paralysis was on a whole more frequently in the hip, and diminished in frequency toward the foot, that is, the individual muscles in the upper segment were more often affected than in the lower. It is interesting to note that the paralysis was on the whole lightest in the hip,

next lightest in the thigh, and most severe in the lower leg, that is, the proportion of total to partial paralysis increased as one went away from the hip toward the foot. The legs were affected nearly equally, the figures slightly higher for the right, but no essential difference. This is in marked contrast to the predominance of the paralysis of the left arm.

These facts Lovett explains as corresponding to the functions of the muscles involved. The right arm is used much more actively than the left, and also for more complicated movements. The legs are used equally. It seems that the muscles used actively, continuously, and in a complicated way, are more apt to escape than those used less, or for simpler or less continuous work. This difference may be due to the difference in blood supply, which one would suppose to be greater and more free around the centres governing the greatest activity. If this idea is correct, one would expect to find a higher proportion of difference in older individuals. In 24 patients five years old and younger, there were 12 left arms and 12 right arms paralyzed, a ratio of 1 to 1. In 27 cases over five years of age, there were 20 cases of left arm paralysis and 7 of right, a ratio of 3 to 1. This also agrees with the distribution of the paralysis in arms and legs, which is most frequent near the trunk, the hip and shoulder muscles performing simpler and less continuous tasks than those of the lower leg or forearm, or of the hand and foot.

It has been shown that the muscles of the upper extremities are more severely affected nearest the trunk, and less severely lower down, whereas in the leg this relation is reversed, and the largest proportion of severe paralysis is seen in the lower leg and foot. This is probably due to the weight coming on each muscle in the activities of the upright position. In the arm the deltoid, triceps and biceps are all used to hold up the arm against the shoulder-joint, so that the upper muscles have a greater amount of weight to take care of than those lower down. This, of course, is reversed in the legs, as the lower muscles have more weight to carry than the upper ones. Whether this explanation is correct or not is a question, but there is no question about the correlation of the facts. The severity of distribution cannot be connected with the size of muscles or function of a peculiar sort, nor can it be connected with local changes in the circulation. It is not associated with anterior or posterior, and does not seem to be connected with spinal localization. The distribution as regards the severity is in proportion to the weight to be met by the different muscles, and may be due to the retardation of the recovery of the muscles that work against the greatest weight. This has a bearing upon the treatment, and may account for the ill effects on muscular recovery from overuse.

Lovett's conclusions are only tentative, and will be subject to further studies, but he seems to have definitely proved that there is another factor beside the plain anatomical distribution of the lesion in the cord,

which determines something of the extent and severity of the residual paralysis.

The *treatment* of an acute infection like this, in which the motion is interfered with, both on account of the paralysis and the pain, must be begun by an early stage of rest, and it does not seem to be rational to attempt either massage or electricity in the early stage. The massage and other treatment is best put off until after the sensitiveness has disappeared. Lovett tested the truth of this by having a case, in which the sensitiveness seemed to be unduly prolonged, massaged. This was done by a highly skilled masseuse under his personal supervision for five minutes a day. In one week's time the sensitiveness had increased, so that the treatment was omitted, and both legs put up in plaster of Paris. When this was removed one week later, it was found that the sensitiveness had wholly disappeared. Frequent changes of position are desirable, and there is no objection to the sitting position in the open air, or to immersion in a warm bath, with as much motion as can be accomplished without discomfort. As soon as the tenderness disappears, the active treatment should be begun, and after this stage, the sooner the patient can be gotten up and about the better. Lovett prefers to defer the active treatment until after the first four weeks in any event, but it may be delayed much longer. Skilful massage, electricity, and muscle training are the principal means of treating these patients, apart from such general treatment as may be demanded. Between massage and electricity there is little choice, except that massage is much more easily given, and electricity is easily abused, and not of much value unless the treatments are carried out by someone skilled in the matter.

The muscle training is perhaps the most important of all, and if carried out systematically, may result in the motor impulses being sent to the muscle over new connections. If necessary, some form of apparatus may be used in the beginning to enable the patient to get about, and later, after three years or more have elapsed, various operative procedures may be undertaken.

One point of very great importance in treatment is to avoid overuse, either by too much exercise, too much massage, or too much electricity. The tendency is to overdo all of this in an effort to get the quickest possible results, but it is a well-known fact that a partly paralyzed muscle, in which the power is returning, may have the function entirely done away with by excessive use or too much stimulation.

MacKenzie[1] has contributed an article dealing with the treatment of poliomyelitis, in which he lays particular stress on early rest, and to secure this early in a case he used a special splint. He lays great stress on the exact position, and if splints cannot be used, he suggests the use

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[1] British Medical Journal, January 9, 1915, p. 60.

of pillows for fixing the limbs more or less in the position desired, by means of safety pins. The arm, he thinks, should be abducted and the elbow flexed. The legs he believes should be in such position that the anterior superior spine should be on a level, the foot should be at right angles to the leg and prevented from becoming inverted or everted. The knees should be extended, the hips slightly flexed. On the other points, as reëducation and the use of massage, he believes that both should be commenced very slowly, and with great care.

He makes one other curious suggestion, and that is, the use of the thymus gland, suggesting that children be given from 15 to 20 grains each twenty-four hours, beginning in the early stage. His reason for the use of this is interesting, it being that the gland is at its maximum when the muscular action and coördination are developing, and when these have been well established, it begins to disappear. Unfortunately MacKenzie does not give any statistics regarding its use.

**Rats and Spread of Plague.** In studying the rodent plague in New Orleans, it seemed very evident that the dissemination of the infection was due to the traveling of the rats. A short study on this subject has been published by Creel.[1] He found that the diffusion of the rat infection was progressive and fairly symmetrical in a fan-shaped zone radiating for a distance of two or three miles from the earlier foci near the river front. There does not seem to be any thoroughly executed experiments on the subject of the migration of rats, although a number of abortive attempts have been made along these lines. The English writers in India have alluded to rat migration as a possible element in the spread of plague, but who regarded it as of little importance, considering infected fleas in clothing or merchandise as the chief means of transferring the infection.

The Commission which studied the plague at Bombay state that they observed nothing to show that rats are in the habit of migrating from one quarter of the city to another, and similar views are held by the Cuban authorities in regard to the plague in Havana.

In order to obtain definite facts of the movements of rats in a city, a number were collected and after being carefully marked, were liberated. The species used were the Mus. norvegicus. One hundred and seventy-nine rats, 93 full grown and 86 half-grown, were released in the central residential section of New Orleans. In this area are the usual number of grocery stores and miscellaneous food depots.

The manner of marking the rats was considered important, for any conspicuous branding would result in making him an outlaw from his fellow-rats with the probability of early death. The rats were marked by punching both ears with an ordinary tonsil punch, removing a small section from the centre. The mark so made was hardly noticeable

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[1] Public Health Reports, June 4, 1915, p. 1679.

under natural conditions. The traps were removed from the four blocks contiguous to the site where the rats were turned loose for ten days and then replaced. Intensive trapping continued throughout the rest of the city. The first rat, trapped at a considerable distance from the point of release, had traveled nineteen blocks, or about one mile in about forty-eight to sixty hours, crossing one main traveled avenue 150 feet in width. Within two weeks a number of rats were taken from points four miles distant from the place from which they had been released. Forty of the rats from the first series that were released made wide-spread excursions. The second series released in a section in which was a large quantity of foodstuff and in which there were numerous drains, which provided harborage for the rats, only 8 of these out of 113 made any extensive travel. The chief difference was apparently in the food supply, but it seems that the rats have a distinct tendency to migrate without any particular reason that can be assigned.

A Plague-like Disease Transmissible to Man. Three years ago, McCoy,[1] working in the Federal Laboratory in San Francisco on the distribution and epidemiology of *plague among the California ground squirrels* encountered a disease of particular interest, in that the lesions in ground squirrels, guinea-pigs, white rats, and gray mice rather closely simulated those due to plague. Later, McCoy and Chapin[2] described the *Bacterium tularense*, which they isolated and proved to be the cause of this disease. Extensive experiments have been made with this microbe, and, in addition to the above animals, it has been found virulent for rabbits, gophers, and Java and rhesus monkeys. The adult Norway rat was usually immune, but the young were occasionally susceptible. Sheep were found to be occasionally susceptible, while calves, pigs, goats, cats, dogs, and pigeons were found to be immune. Inasmuch as the disease is virulent for monkeys, it might be expected to occur in human beings, and Wherry and Lamb have reported 2 cases. The first has been reported in detail,[3] and occurred in a meat-cutter in a cheap restaurant, who was suffering from an acute ulcerative conjunctivitis, with involvement of the preauricular and cervical glands on the corresponding side, fever, and marked prostration. The second case was a farmer's wife, who also had an ulcerative conjunctivitis of the left eye, with marked edema, involvement of the pre-auricular and cervical glands, and marked prostration. The temperature in this case went once to 104° F., and her illness lasted over two months.

Searching for the source of infection, wild rabbits were suspected, as they were the chief variety of game sold in the markets. It was further found that the wild rabbits in Indiana and Kentucky were dying in large numbers. An examination of two rabbits found dead

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[1] Public Health Bulletin, April, 1911, No. 43.
[2] Journal of Infectious Diseases, x, 61.
[3] Ibid., 1914, xv, 331.

on a farm showed the gross lesions of the disease, and were proved to be infected with the Bacterium tularense.

This disease is of particular interest, inasmuch as it has escaped observation. While the human cases described had handled wild rabbits, and were infected through the conjunctiva, it seems highly probable that other types of infection may occur in man. Judging from the results of animal experiments, it would seem possible that ulcerative rhinitis, ulcerative or membranous sore throat, gastro-intestinal infection, or lymphadenitis secondary to skin infections might occur. Experimental susceptible rodents may be infected by feeding, or by inoculating the eye, nose, or an abrasion of the skin. The disease apparently may develop in animals from association, and may also be transmitted by the bites of fleas, as has been demonstrated by McCoy and Chapin. The lesions found in the rodents are very much alike, and are characteristic. At the point of inoculation there is a dry, yellowish exudate, and from this there are congested vessels radiating to the regional glands, which are enlarged, firm, and buried in very much congested periglandular tissues. The spleen and liver are congested and hypertrophied, and show numerous foci of necrosis. There are sometimes a few small tubercle-like deposits in the lungs, and sometimes small areas of consolidation.

The bacillus has not yet been demonstrated in smears from human cases. In smears from rabbits or guinea-pigs the organism can be found in large numbers. It does not stain deeply, but is demonstrated most clearly by gentian violet. When so stained, it appears as short rods varying from 0.5 to $1\mu$ in length, and less than $0.5\mu$ in diameter, surrounded by a distinct capsule. A few hours after the death of an animal the organisms in the tissues round up in the coccoid form. It will not grow on any of the ordinary laboratory media, even if it contains the blood of susceptible animals, but it can be isolated on coagulated egg yolk.

It is more convenient to resort to animal inoculation for diagnosis, as cultures are liable to fail. The guinea-pigs usually die of the disease in about three days, and rabbits in from three to six days.

Wayson[1] has made some experiments on the transmission of this disease by means of flies. He found that the Stomoxys calcitrans transmits the disease from guinea-pig to guinea-pig, particularly if the animal first bitten has the disease in an advanced stage of bacteremia. The house fly apparently does not transmit the disease by biting, but when infected and allowed to crawl on the conjunctiva, especially if the tissues were somewhat abraded, readily produced a typical conjunctivitis.

These experiments have an interest in connection with plague, as it seems possible that the stable fly might be able to transmit that disease.

[1] Public Health Reports, December 18, 1914, xxix, No. 51.

**Pneumonia.** The Early Administration of Vaccine in Pneumonia. Wynn,[1] believes that in pneumonia the use of a stock vaccine made from a highly virulent strain of pneumococci is of very distinct advantage, if injected very early. Most of the cases in which he had used the vaccine were seen first on the fourth day or later, but these have not been considered. In 6 cases the injection was made within the first twenty-four hours from the onset of symptoms, 3 during the second day, and 6 during the third day. The results in these cases were so far superior to the cases in which the vaccine was given late, that attention is called to this method.

The first 3 of these cases received 25,000,000 pneumococci. The subsequent cases were given either 50,000,000 or 100,000,000. The temperature dropped almost immediately to normal, and in most cases the lung cleared up very quickly. In some of the cases the temperature remained low, but the patients presented the picture of pneumonia, with the visible signs, but without any toxemia. The most striking thing about Wynn's results is the sudden drop in the temperature, and its remaining low. A careful study of his cases does not seem to show that the disease was really very much shortened over what might ordinarily be expected. There was only 1 fatal case, and that was in a case complicated with pregnancy and labor.

In view of the brilliant work that has been done by Cole and his associates at the Rockefeller Institute, it seems a pity that a more careful selection of the organisms could not be made, so as to suit the particular strain of pneumococcus to the case being treated. Wynn believes, however, that even if some errors are made, the fact that the vaccine is used early more than counterbalances possible error in diagnosis. He does not mention the type of pneumococcus used.

The Vasomotor Mechanism in Pneumonia. It has been very generally believed and taught that the failure of the peripheral circulation is frequently the cause of death in pneumonia. This has been based partly on the assumption that the blood-pressure was abnormally low in most fatal cases of this disease, a belief not borne out by the evidence now at hand, and also on certain experiments which seem to show that the vasomotor nervous mechanism is paralyzed in fatal pneumonia. There are numerous references to the low blood-pressure of the disease in the writings of the earlier authors, and the subject has been restudied recently by a number of competent observers, including Weigert, who, in 1911, reviewed the results of the earlier workers. He found that previous to his studies the data recorded were so contradictory that no conclusions could be drawn from them. He reported 38 cases of his own, in which there were 6 deaths, and the blood-pressure in these was not low. Of the cases that recovered,

[1] British Medical Journal, March 13, 1915, p. 458.

in 8 there was no change in the pressure; in 9 the blood-pressure curve showed a gradual fall, which reached its lowest point on the average nine days after the crisis; in 3 cases there were steep falls, which bore no relation to the crises; and in the remaining 9 the blood-pressure curve rose progressively. He concluded that no rule could be established for blood-pressure in pneumonia, and that it had no prognostic significance.

Gibson, of Edinburgh, formulated a rule that when the arterial pressure, as expressed in millimeters of mercury, does not fall below the pulse-rate as expressed in heart beats per minute, the fact may be taken as of excellent augury, while the converse is equally true, that is, when the pulse-rate per minute is higher than the pressure of the millimeters of the mercury, the equilibrium of the circulation is seriously disturbed.

In 1911 Lambert studied a series of 48 cases, which showed that Gibson's phenomenon was not to be relied upon, and at that time I called attention in PROGRESSIVE MEDICINE to the fact that with our present knowledge of the blood-pressure in pneumonia, it is not safe to lay down any hard-and-fast rules, and that many more observations will have to be made before one can speak dogmatically about it.

In 1914 Newburgh and Minot compared the course of the systolic pressure in 19 fatal cases with the pressure in 26 cases which recovered. These showed that the systolic pressure in the fatal cases was continuously above the systolic pressure of the persons who recovered. Newburgh[1] has contributed another article on this subject, dealing with the state of the vasomotor centre, and he has furnished evidence that it and the afferent and efferent nerves are normal in pneumonia.

In 1909 Romberg and his associates studied this subject experimentally in rabbits, and they concluded that death in acute infectious diseases was the direct outcome of paralysis of the vasomotor centre in the medulla. These experiments were accepted by clinicians without question, and the chief therapeutic efforts in pneumonia continued to be directed toward the vasomotor centre, with the resulting administration of strychnine and other stimulants. Newburgh believes that the evidence of the Romberg experiments is of the negative sort. In connection with Porter,[2] he succeeded in producing positive results in the fatal pneumonia in rabbits, cats, and dogs, as well as in pneumococcic septicemia in rabbits. Instead of using the reflexes from the mucous membranes, they cut the depressor and the sciatic nerves, and stimulated the central ends. Without going into the details of their experiments, they showed that the vasomotor centre was not impaired in any of the examples of fatal pneumonia studied, and Newburgh

[1] American Journal of Medical Sciences, February, 1915, p. 204.
[2] American Journal of Physiology, 1914, xxv, No. 1.

concludes that the view so commonly held regarding the paralysis of the vasomotor centre in pneumonia is incorrect, and that the vasomotor reflexes are normal, even in fatal cases of the disease.

**Pyorrhea Alveolaris.** THE TREATMENT OF PYORRHEA ALVEOLARIS BY INJECTION OF MERCURY. I have commented once or twice upon the method suggested by Wright on the treatment of systemic bacterial infections. During the past year he has contributed two articles, the first in connection with White[1] on the subject of the treatment of pyorrhea alveolaris and the systemic infections arising from it. In the cases treated, the local treatment was carefully carried out. This consisted of the usual removal of calcarious deposits and the removal of the pus as far as possible, together with the extraction of the hopeless teeth and roots. The mercury treatment consisted in administering, every seventh day, one grain of mercuric succinamid until the discharge of pus had entirely disappeared and the gums regained their normal appearance. In women the dosage advised is from one-fifth to two-fifths of a grain less. In any cases in which the symptoms of mercury poisoning are met with, the dose should be decreased and the drug omitted until these symptoms have disappeared. Up to the time of the second report these two observers had treated 60 consecutive cases and with 100 per cent. of cures, and not a single recurrence. The longest period of time to effect a cure was 142 days, and the shortest 4 days, the average treatment was 17 days. The number of injections varied from one to seven. In addition to this series, White, of the Boston Navy Yard, reports 29 consecutive cases with 28 cures, 1 case leaving before the treatment was finished; and Ladd and Blaisdell, of Portsmouth, N. H., report 8 consecutive cases, all of which were cured. In some of these cases the systemic effects were very marked, there being 1 case of acute arthritis, and 1 case of chronic arthritis. These results of Wright's are so striking that further investigation of this method of treating systemic infections should be undertaken. It is very much along the same line as the treatment suggested several years ago by Bacelli, who suggested the use of injections of bichloride of mercury.

**Rabies.** PARALYSIS DURING ANTIRABIC TREATMENT. This subject has attracted considerable attention and is probably of somewhat greater importance than was formerly believed. It was made the subject of study in 1913 by Simon, who was able to find 100 cases in a series of 217,774 patients treated, and in this number there were 19 deaths. Since that time a number of other cases have been reported, so that the total is now 119, and, if certain other cases which were plainly not included in Simon's article are added, the total is 133, of which 25 resulted fatally. It is not possible to estimate the percentage of cases exactly, because the number of cases treated has not always been stated,

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[1] Medical Record, March 13, 1915; Dental Cosmos, September, 1915.

but in Simon's cases, in which the number was known, 1 case of paralysis occurred in each 2,177 of those treated. Inasmuch as some of the cases did not find their way into literature, the true figures may be somewhat higher.

Hasseltine[1] has reported 2 instances. In a previous article he stated what was generally believed to be true: that paralysis does not follow treatment given according to the dilution method of Högyes. He now states, however, that he found 3 cases in patients treated by this method, so that this view will have to be modified, though it is still stated that it is less frequent with the dilution method than it is with the dessication method.

The nature of the paralysis is not very well understood. In Europe there is a growing belief that these cases of paralysis are due to street virus infection, and that they are not really due to the treatment, but are atypical and abortive rabies. Cases have been reported, however, in which the absence of rabic infection was proved by autopsy, and in which no Negri bodies were found.

Hasseltine states that he knows of an unreported case of paralysis that developed on a patient who was not exposed to street virus infection. While administering treatment to the patient, he accidentally stuck his finger with the emulsion of fixed virus that had dried only one day. He took the regular course of treatment and later developed paralysis, from which he ultimately recovered. It would seem that paralysis is more apt to occur under certain conditions, and to a certain extent by taking suitable precautions the number may be lessened. Exposure to cold, either from cold baths or weather conditions, and from fatigue, are both mentioned as possible predisposing factors, while alcoholism and syphilis are very important factors, and neurasthenia has also been spoken of in this connection.

**Rat-bite Disease.** In 1913 I called attention to some observations that had been made upon the subject of what is known as rat-bite, or, as it is called in Japan, *sokodu*. At that time the disease had been met with in China and Japan and had also been reported from America, England, and Italy, and I also noted the observations of Hata who used salvarsan with very marked benefit in the majority of cases. His report, however, only includes observations on 8 patients. There have since been various cases reported, and in 1913 Proescher noted a case occurring in this country, the first for a number of years. Crohn[2] has made a study of the literature of the disease and has reported fully on a case which he himself has studied. Up to January, 1914, including his case, there were 53 instances of the disease. The disease follows the bites of the rat, and after a variable incubation period, begins with a

[1] Public Health Reports, July 30, 1915, p. 2226.
[2] Archives of Internal Medicine, 1915, xv, 1014.

chill, or there may be regular recurring chills, fever, and sweats. These last a few days and at the same time there is a bluish-red eruption which may be localized or more or less generalized over the body. The disease is of variable duration and often affects the individual for a long time, being characterized by remissions, by progressive emaciation and weakness, and marked nervous symptoms. Many of the cases occurring in the literature were found in the older periodicals and include the following cases: Japanese, 24; American, 17; French, 2; Scotch, 1; British, 7; Italian, 1. Miyake believes that the frequency of the disease in Japan is due to the fact that the houses are so constructed as to afford little protection from rats, and the fact that the same conditions obtained in the earlier days of American life may explain the cases occurring at that time. The disease is most liable to affect farmers and seamen, owing to their greater liability of being bitten. The age incidence varies from one to over fifty-five years, most of the cases occurring between five and fifty-five, in other words, the period of greatest activity. The disease is somewhat more frequent in males than in females.

The animal doing the biting has generally been described as a large brown or a large black rat, and no cases are on record that were caused by white rats or by mice. Most of the wounds are on the hand and arm or head and face. There does not seem to be much difference in regard to the prognosis as regards the site of the wound, although the face and head injuries seem to run a more severe course and to have a shorter incubation period. The incubation period is eight days for face and head injuries, as opposed to fourteen days for wounds on the extremities. The extent of the injury does not seem to make any difference in the course of the disease, as some very severe instances are reported where blood was not even drawn. The wound usually heals without any particular attention being paid to it until the occurrence of the paroxysm, when there is pain, swelling and a hard edema about the wound. Sometimes there is a formation of a vesicle followed by ulceration. Only two autopsies have been reported, and no particular changes are on record except that there is an increase of the cerebrospinal fluid and the pial vessels.

The paroxysms of the disease are attended with marked fever, usually from 103° to 105°, and with the bluish-red, slightly raised eruptions previously mentioned. The nervous symptoms may be very marked and consist of increased reflexes, hyperesthesia or paresthesia, pains in the muscles, difficulty in swallowing, and sometimes paralysis. There may be evidence of nephritis. The paroxysms vary from four to five days, they are followed by a period of remission lasting from four to five days. Both paroxysms and remissions may show considerable variation in their duration. There may be only one attack, but as many as twenty-six have been reported.

The convalescence is long drawn out. The disease seems to be more severe in cases in which the incubation is short. The disease is evidently one that is caused by some sort of parasite and will probably be found to be a spirochete, inasmuch as there is a certain similarity of the disease with relapsing fever and syphilis, both as regards nerve symptoms and the apparently good effect of salvarsan. There is some reason to believe that the disease may be caused by a protozoan, chiefly the occurrence of remissions and paroxysms. Both Proescher and Ogata succeeded in inoculating successive generations of guinea-pigs with the production of the essential characteristics of the disease. The examination of blood cultures and blood smears have been negative, with the exception of certain findings of Ogata. The organisms described by him were found in the blood smears from the lymph nodes and in smears from a local lesion. He classed them as a form of sporozoa. His observations have not been confirmed by subsequent workers. Blood taken at the height of the fever shows a leukocytosis varying from 16,000 to 21,500, and the polynuclear cells may run to 87 per cent. and in some instances the eosinophiles have been markedly increased to 8, 11, and 15 per cent. Between the attacks of fever there is no leukocytisis.

**Ringworm.** VACCINE TREATMENT OF RINGWORM. Some very interesting work has been done on this subject by Strickler, working with Kolmner.[1] They have demonstrated that the blood of children suffering from ringworm contains a specific antibody which produces a positive complement-fixation test and gives a positive skin reaction. They found that 78 per cent. of children suffering from Tinea tonsurans gave positive fixation tests. The ringworm fungus was used as the antigen for the skin test. They used a suspension of 0.05 c.c. of dead ringworm fungus in salt solution which has been briefly centrifuged at a low speed so it is of about the same density as luetin. The majority of children suffering from ringworm of the scalp give positive reactions but there is no reaction in the controls. The reaction occurs twenty-four hours after the injection, and the positive result consists of a central nodular area of infiltration and a surrounding reddened areola.

Various attempts have been made to produce a vaccine for ringworm, and Plato, as early as 1902, grew the fungus in a culture medium consisting of a 3 per cent. maltose bouillon. This was grown for two or three months at room temperature and then broken up as much as possible and filtered through a sterilized filter paper and preserved with phenol. Von Truffi tried filtering the culture through the Chamberland filter. Neither of these products seemed to have any value in treatment, although skin reactions could be produced with them.

Strickler's method consists in soaking the hairs obtained from the

patient in absolute alcohol from fifteen to twenty-five minutes, washing in sterile salt solution, and then planted in French-proof agar in Erlenmeyer flasks. The stoppers of the flasks were paraffined and the culture allowed to grow twenty-four days on top of the incubator. This was finally triturated with the addition of chemically pure sodium chloride, and then enough sterile distilled water was added to make the mixture as strong as normal salt solution. The growth from an ordinary Erlenmeyer flask makes up about 500 c.c. of vaccine and this is killed by heating for one hour at 60° C. This vaccine was used in doses from 0.5 to 2 c.c. Larger doses than this are of no particular advantage. Injections are made every five or six days, generally in the region of the scapula. After the patient has had six or seven injections, an infiltrated area sometimes develops at the point of injection. There were no constitutional reactions after any of the injections. The number of injections given vary from 7 to 22, and the patient is not regarded cured until the hairs are found to be free from fungus when examined microscopically.

In addition to this, they suggest the use of oil of cade and olive oil, equal parts, to be used twice a day for a period of two weeks, and then sulphur ointment, 20 grains to the ounce, applied twice a day for a similar period of two weeks.

The vaccine treatment usually extended between three and four months, and if, after seven or eight injections, no improvement was noticed, the stock vaccine was discontinued and an autogenous one employed. They have treated 20 cases of various grades of severity 14 of which are cured, 1 markedly improved and still under treatment, 1 improved and still under treatment, and 3 improved but who left before the treatment could be completely carried out. One died from an intercurrent pneumonia.

**Rocky Mountain Spotted Fever.** It is interesting to note the progress made in the study of this disease during 1914. Fricks[1] has reviewed the work done under the direction of the United States Public Health service. This work was begun in 1902 by Cobb, who reported upon the disease in the Bitter Root Valley, Montana. Subsequently, the disease has been studied by Anderson, Stiles, Francis, King, McClintic, Rucker and Fricks. The two most striking contributions are the studies of Anderson and Goldberger in 1909, showing the relation of spotted fever to typhus fever, and the studies of Stiles on the wood tick, Dermacentor andersoni, which is responsible for the transmission of the disease to man. I have noted in PROGRESSIVE MEDICINE the progress of the various studies, and of the various methods used in attempting to eradicate this tick, and with it the disease. The chief methods have been the reclaiming and cultivation of all the arable land in the Bitter

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[1] Public Health Reports, January 15, 1915, p. 148.

Root Valley, burning over of the foot-hills, the killing of wild animals, and the hand picking and the dipping of domestic animals in arsenical dips, and sheep grazing.

In certain districts the destruction of the wild animals has seemed to lessen the incidence of the ticks, and the dipping of domestic animals has also helped, but these measures alone will hardly suffice to eradicate the disease. The present view of the situation is that the disease may probably be eradicated by sheep grazing, and Fricks believes this may be accomplished by removing the undergrowths, and keeping it down by continuous grazing, the ridding of the area of large mammals, both domestic and wild, which serve as hosts for the adult ticks, and the destruction of the ticks themselves, which takes place in the coats of the grazing sheep. He believes that this sheep grazing may be carried out on a sufficiently extensive scale, and be placed upon an economic basis, so that the clearing of the valley of the disease may be done without any very great amount of expense. All the other methods suggested have been practically prohibitive on account of the amount of labor and money required. A very large number of the adult ticks can be destroyed in one season, as has been demonstrated by actual experiments, but, in order to determine what will happen eventually it will be necessary to have the experiments carried on both extensively and over a period of three or more years.

The amount of the disease in the United States varies somewhat. In California there have been no cases reported since 1912, and the same is true of Colorado, although it is believed that the disease may be present in certain parts of the State. Some 9 cases have been reported in Nevada, and 6 in Oregon, and the disease probably also exists in Utah, Washington and Wyoming. In Idaho, in 1914, there were 386 cases with 15 deaths, which is a remarkable increase over the 239 cases and 4 deaths occurring in 1913. In Montana 12 cases with 7 deaths were reported, 10 of the cases and all of the deaths occurring in the Bitter Root Valley.

**Scarlet Fever.** THE INCLUSION BODIES IN SCARLET FEVER. Since Doehle's first publication, I have noted a number of different studies that have been made upon this subject, and recently Isenschmid and Schemensky[1] have reviewed the work of a number of investigators. There are a great many different views held regarding their importance and diagnosis, and a very few at the present time regard them as the specific cause of scarlet fever. The bodies are small masses of substance, which stain a little less darkly than the nucleus, and are seen in the protoplasm of the polynuclear leukocytes. The authors just mentioned studied 80 cases of typical scarlet fever, and found these bodies present in every one. The size and shape of the bodies differ consider-

[1] Münchener medizinische Wochenschrift, 1914, lxi, 1997.

ably, and they believe that when they are long and rather triangular in form, with a long tail-like end, it is more indicative of scarlet fever than when any of the other forms are present. These bodies are found in 4 out of 5 cases of ordinary lobar pneumonia, and they are found in numerous other forms of bacterial infections. In the differential diagnosis between diphtheria and scarlet fever, it has been found that the presence of a large number of bodies points rather to scarlet fever than to a diphtheritic process, and they are not present in cases of German measles, measles, or whooping-cough.

Taking all the evidence at the present time, it might be stated that the diagnostic value is perhaps greatest in their absence, inasmuch as if they are not present the case is probably not scarlet fever. They are found most often the first four days. The large number of inclusions in scarlet fever may also be regarded as helpful, but it must be borne in mind that occasionally inclusions are found even in normal individuals and they may be found in considerable number in streptococcic infections, especially of the throat, and particularly in certain forms of tonsillitis.

**Schistosomiasis.** THE SPREAD OF ASIATIC SCHISTOSOMIASIS. Our increasing interest in the far East makes a knowledge of their transmissible diseases more and more important. Among the seldom-heard-of diseases is a form of schistosomiasis, first described by Catto, in 1904, in the Cragg Prize Essay in the London School of Tropical Medicine. This disease Catto found in Chinamen, and it was almost immediately shown to occur in the cat and dog. It thus became possible to study the mode of infection of a human form of schistosomiasis in small susceptible animals. In Africa, the general opinion of local practitioners, and also native tradition, has led to the view that infection is acquired when bathing. Looss advanced the idea that the infection took place through the skin, and, in 1911, Matsurra and Yamamoto showed that in animals experimentally infected with the Schistosoma japonicum, by exposure in water from infected rice fields, there occurred short ciliated larvæ in the skin. In 1913 Kay stated that miracidia kept in water for days lost their ciliated covering, and underwent further development to form cell masses, which he believed resulted in the infected stage. Numerous workers have been unable to produce the disease experimentally by applying the miracidia to the skin.

Leiper and Atkinson,[1] working under a special grant from the Tropical Disease Research Fund and the London School of Tropical Medicine, went to the far East to study the mode of spread of *bilharziasis*, and to obtain, if possible, some definite experimental evidence on the subject. Their studies were interrupted by the outbreak of the war in August, 1914. Their studies were chiefly made about Shanghai, and they

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[1] British Medical Journal, January 30, 1915, p. 201.

conclude that the intermediate host is a snail, with small, dark-colored shell, with seven spirals, commonly found in the waterways and ditches. Livers of these snails were teased in fresh water, and the miracidia allowed to become free and swim about. Laboratory-bred mice were then immersed in this, but none of the fluid was allowed near the mouth. At this point of the investigations, their return home was made necessary. The mice that had been subjected to infection were taken along, but most of them died on the voyage. In one, a single male schistosome was found. One mouse, however, was safely transported to the London School of Tropical Medicine, and live male and female schistosomes were found in the portal vessels. The result of this study, even though interrupted, seems to leave little room for doubt that the schistosome has a life-cycle similar to that of other digenetic trematodes.

**Smallpox.** A LABORATORY METHOD FOR THE DIAGNOSIS OF SMALL-POX. There are a number of infectious disease in which, after an animal is previously sensitized, a cutaneous injection of the virus will give rise to an inflammatory reaction which is of some value in diagnosis. This fact in relation to smallpox was noted by Jenner in his first observations, but very little notice was taken of his description, until similar reactions had been studied in other diseases in recent years. Tieche, in 1912, studied the subject with regard to smallpox and chicken-pox, and found that in persons who were immune to smallpox the reactions were not produced by material taken from varicella cases. He suggested the use of these reactions in differential diagnosis. He suggested also that the virus be heated to 70° C. for five minutes in order to avoid accidental infection with syphilis. He also suggested that the physician could make the tests on himself if he was properly prepared by previous vaccinations with vaccine virus. He subsequently reported his findings in using this method in 34 cases; in 14 of these, reactions were noted on three previously vaccinated persons. The remaining cases showed no reaction and were subsequently proved to be either varicella or erythema multiforme.

Force and Beckwith,[1] on studying this work, came to the conclusion that more consistent results could be obtained by trained laboratory workers using sensitized animals. They studied the effect of vaccine virus, smallpox vesicle contents, and varicella vesicle contents on the skins of previously vaccinated animals. The virus was applied to the skin by intradermal injections. The technic is as follows: On the day preceding the dose, two areas about 5 cm. in diameter are clipped and shaved on the back of a previously vaccinated rabbit. The injection is made directly into the skin of an amount between 0.05 and 0.1 c.c. The reaction appears within twenty-four hours after the injection but may not reach its maximum until the second day. It is characterized

[1] Journal of American Medical Association, August 14, 1915, p. 588.

by an infiltration of the skin, with redness, which fades before the in-
filtration disappears. It disappears gradually. They found that they
were able to produce typical reactions by using vaccine virus and also
by using the contents of smallpox vesicles. This material could be kept
for at least nine days at ice-box temperature, and would still give a
reaction. Material from chicken-pox cases did not give a positive
reaction in any instance. The rabbits used retained their cutaneous
allergy to vaccine virus for a long while, some of them for one year
after the original vaccination. Inasmuch as the material from the
vesicles will react after at least nine days, it would seem feasible to
use this method in confirming opinions in cases in which the diagnosis
was doubtful. It is unfortunate that other material could not be used
in order to arrive at a diagnosis at an earlier time, as one would have
to wait until the vesicles were formed before getting virus for the test.
Nevertheless, if this work is confirmed, it will afford health officers
a very simple means of checking up their diagnosis. The previous
methods of the laboratory diagnosis of smallpox consisted of the ad-
ministration of the cell inclusions first described by Guarnieri in 1892.
These are found in the proliferating epithelial cells of the vaccinated
cornea of the rabbit, but it has been shown by Swellengrebel that the
virus of varicella will produce bodies similar to those described by
Guarnieri.

Paul[1] has suggested a method of differentiating doubtful cases of
smallpox and chicken-pox which consists of scarifying the cornea of
a rabbit with the edge of a cover-glass which has been dipped in the
smallpox vesicle contents. The reaction which takes place consists
of small vesicles which are visible at the end of thirty-six hours by means
of a magnifying glass and to the naked eye at the end of forty-eight
hours. In three or four days the spots turn into corneal ulcerations.
The eyeball is enucleated at the end of forty-eight hours and placed
in a mixture of absolute alcohol and mercuric chloride. The necrotic
areas in smallpox appear under the lens as white circular punctures.
The inoculation with material from chicken-pox does not produce these
spots. This method requires very careful technic and is, of course,
susceptible to error, so that the method of Force and Beckwith is very
much to be preferred to the method of Paul, on account of its simplicity,
and to the method of Tieche, inasmuch as it does away with the possible
danger of infecting human beings either with syphilis or some pus-
producing organism.

**Sporotrichosis.** The Relation of Animals to the Human Sporo-
trichosis. In the recent years, in Progressive Medicine, I have
commented somewhat extensively upon the subject of this disease as it
appears in man in the United States. Sufficient evidence has been col-

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[1] Zentralblatt f. Bacteriologie, Orig., March 13, 1915, p. 513.

lected concerning the prevalence of the disease in animals to warrant consideration of the relation of human and animal infections. In 1907 Pearson reported an epizoötic lymphangitis occurring in the western part of Pennsylvania. This resembled glanders but did not give the immunity reactions of that disease. In the few years following his publication, similar cases were reported from Ohio, North Dakota, and Iowa. In 1910 Page, Frothingham, and Paige published an account of finding the sporotricha in the pus of abscesses from cases of this epizoötic. These observations have been confirmed by Meyer, and also by Mohler.[1] The last named has given an account of his own findings. The disease is seen in various domestic animals, particularly in horses, but it had been described in both this country and France in dogs, and it has been found in rats, both in Brazil and France. There are quite a number of instances in the literature in which the infection was probably carried from animal to man, either through bites or by handling hides. In most of the instances, if not all, the animals were not visibly infected, but Meyer has been able to demonstrate the sporotricha in the mouth of an apparently normal horse, and he has also been able to grow the organism from the skin and hairs collected from animals exposed to those suffering with the disease. It does not seem at all improbable that animals may act as passive carriers of the parasite. Meyer is also able to infect culture media with sporothrix spores through ordinary house flies three days after they had fed on material from infected rats. The infection of animals probably has something to do with soil conditions, as most of the horses found infected worked on farm lands recently opened for cultivation. While all this is true, the actual danger of contracting this disease from animals must be exceedingly slight, as only in 2 cases, out of some 400 that have been reported in this country and abroad, could the disease in man be traced with certainty to the horse. In the parts of Pennsylvania in which the many cases of this disease have been seen in animals, it has not been found in the farmers or veterinarians who have handled infected animals.

**Sprue.** In addition to his first article,[2] Ashford[3] has detailed his further experience in making cultures. He uses Sabouraud's glucose agar 4 per cent., which he regards as an ideal medium for the monilia. Twenty-two cultures made from cases of typical sprue were all positive at the first examination. In 47 cases who either had sprue, or history past or present more or less suggestive of it, and all except 7 with normal tongues at the time the cultures were made, showed 10 positive cultures. Of 31 persons examined who did not have sprue, only 1 was positive for monilia, and he had a suspicious past history, and his wife had a marked case of the disease. The opinion that this disease is due to

[1] Journal of American Medical Association, August 15, 1915, p. 579.
[2] Ibid., March 6, 1913, p. 810.       [3] Ibid., June 5, 1915, p. 1893

a monilia has been advanced by Bahr, in Ceylon. His cases are due to the *Monilia albicans*, which has not been found in Porto Rico.

The *treatment* usually consists in the administration of food in which the monilia does not flourish and which it cannot ferment. Ashford suggests the following:

1. A strict milk diet, giving 8 ounces every two hours on nine occasions a day for four days, and thereafter increasing the dose by one ounce every four days until 13 ounces every two hours have been taken for one week. The milk should be taken cold through a straw, slowly, and half a culture tube of the liquid culture of the Bulgarian strain of the Bacillus acidus lacticus should be added to each feeding, for the purpose of overgrowing bacterial sources of fermentation. On reaching a dose of 13 ounces of milk, one banana a day should be added, and every four days one more for every ounce of milk to be subtracted per feeding. When 10 ounces of milk every two hours and three bananas a day are reached, the diet may be modified by gradually permitting eggs, fruits and fresh vegetables with a low carbohydrate content. After a few days on this diet the excess of gas usually diminishes; indeed, generally disappears.

2. A strict meat diet, giving 2 pounds of chopped and roasted meat per day, divided into six feedings three hours apart. Few can sustain this diet over a week, but almost without exception it stops the diarrhea. (Carnegie Brown.)

After this week add vegetables, fruits and eggs as above, and reduce meat.

3. A simple fruit diet in which bananas may form the principal feature.

Ashford, in studying this disease in Porto Rico, has found monilia in 4 cases, but he has been unable to demonstrate this organism in apparently normal tongues of convalescents. In one instance, the organism was not found during the height of the intestinal symptoms, but a successful growth was obtained later. This organism has not been demonstrated from the tongues of normal individuals. Of the four positive results obtained, three were in children, one twelve years of age, one two and a half years of age, and one in an infant fifteen months old, which had symptoms resembling thrush, but in which a tentative diagnosis of sprue was made, on account of its duration of four months in spite of treatment, and in view of the fact of frequent recurrences of fermentative indigestion, and the fact that the mother suffered from an aphthous stomatitis, with a violent inflammation of the tongue, just prior to her baby's illness. The fourth was a typical severe sprue in an adult.

SPRUE TREATED BY EMETIN HYDROCHLORIDE. Sprue is of considerable interest on account of our tropical possessions, and also on account of the increased frequency of the disease in the United States through

persons returning from the Philippines and elsewhere, after having contracted it. Schmitter[1] has made a short note on 6 cases treated by emetin hydrochloride hypodermically in $\frac{1}{2}$- to 1-grain doses daily for five days. He adds an additional 6 cases observed by himself and others, and in all 12 there was prompt relief from the symptoms of the disease. With the exception of 1 of these patients, he has been unable to follow the ultimate results, owing to the fact that they returned to the United States shortly after having received the treatment.

In 1 case, a man aged forty, who had been reduced to 117 pounds, the treatment resulted in immediate cessation of all symptoms, and four months later he weighed 156 pounds, and after six months gained to 177 pounds, and was apparently perfectly normal in every way.

**Sparganum in America.** I have called attention repeatedly to the fact that the greater intercourse with all parts of the earth will result in an interchange of various parasites. In 1882 a rare form of infection was described in the far East by Cobbold, occurring either in natives of Japan or China, or in individuals who had traveled in those countries. This parasite is the Sparganum mansoni which is a larval cestode. The parasite was found by Moore[2] at Houston, Texas, in a patient who had never been out of the borders of the United States. The parasite lodges in various tissues of the body and is said to show a tendency to migrate from one part to the other. It measures from 8 to 36 cm. in length by 0.1 to 12 mm. in breadth, and 0.5 to 1.75 mm. in thickness. Moore's case occurred in the breast with a swelling near the nipple from which a worm, measuring 21.5 cm., was removed. In 10 cases which have been reported in the Japanese, the parasite was in the region of the eye in 3 cases, escaped from the urethra in 4 cases, was in the connective tissues of the abdominal region in 1 case, and in the pleura cavity in 1 case. In 9 of the cases, 1 single parasite was found, but in 1 case 12 were found. The parasite has been reported in Egypt in the jackal, and this or similar parasites have been found in British Guiana.

**Tetanus.** INTRASPINAL ADMINISTRATION OF ANTITOXIN IN TETANUS. Last year I called attention to the work of Park and Nicoll in regard to the use of the antitoxin in tetanus. Nicoll has collected 20 cases occurring in and about the City of New York in which the recommendations made have been followed out. The method advised is to inject 3000 to 5000 units into the lumbar region of the spinal canal, preferably under an anesthetic, the volume of fluid injected being brought up to 10 or 15 c.c. by the addition of sterile normal salt solution, the exact amount being regulated according to the age of the patient and the amount of spinal fluid withdrawn. At the same time, 10,000 units are to be

[1] Journal of American Medical Association, January 2, 1915, p. 53.
[2] American Journal of Tropical Diseases, 1915, p. 518.

given intravenously. The intraspinal dose should be repeated in twenty-four hours and a subcutaneous dose of 10,000 units given three or four days later.

The other usual treatment of tetanus is, of course, carried out. With this method of treatment, there were 16 recoveries and 4 deaths. The results are so much better than those ordinarily obtained that this method of using antitoxin in tetanus is to be highly recommended.

Injections of Oxygen as a Treatment for Tetanus. Howitt[1] reported the beneficial results from the subcutaneous injections of oxygen in cases of dyspnea in tuberculosis, gas poisoning, pneumonia, edema of the lungs, bronchial asthma, and in certain operative cases, and the success of this treatment led to the surmise that it might be valuable in cases of tetanus and other anërobic infections. In connection with D. H. Jones[2] some observations were made on guinea-pigs in which they demonstrated that, in certain cases in which oxygen was injected directly into the wound, tetanus was either prevented from developing or very much delayed. Sufficient oxygen was given to raise an emphysema from 3 to 5 cm. in the immediate region of the point of inoculation. Their observations are not sufficiently numerous, or the methods sufficiently well developed, to state whether this method of treating tetanus will be of any value in man or not.

Tetanus and Vaccine Virus. Last year I called attention to the report from the Hygienic Laboratory of the United States Public Health Service on the subject of vaccine virus and tetanus bacillus, and this year Anderson[3] has published an article dealing with this subject which is worthy of careful attention. The United States Public Health Service has exercised supervision over the manufacture of interstate sale of biological products since 1902, and since 1904 Anderson has been collecting statistics and information concerning the occurrence of tetanus following vaccination. The information sought related not only to the patient, but the date of the vaccination and its character, the date of onset of the symptoms of tetanus and the results, whether a vaccination shield was used, the source of the virus, and, if possible, a study has been made of the virus when the samples of the same lot could be secured, and investigation has also been made of other persons vaccinated with the same lot of virus. In addition, a study has been made of the cases of tetanus occurring in soldiers and sailors in the United States Army and Navy during the same period, and also of the results of vaccinations performed in the army and navy. A series of observations were made on rhesus monkeys and guinea-pigs, both of which animals are susceptible to vaccinia and also to tetanus. Virus was used in which virulent tetanus germs were purposely incorporated. Eight monkeys

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[1] Journal of Canadian Medical Association, November, 1914.
[2] Lancet, April 10, 1915, p. 752.
[3] Public Health Reports, 1915, p. 111.

were vaccinated by multiple vaccinations with this mixture of tetanus spores and vaccine virus. All of these monkeys ran the usual course of successful vaccination but none of them showed any evidence of infection with tetanus, although the presence of tetanus organisms was shown by examinations made of the crust or scab. The same observations were repeated, using guinea-pigs, with the same results. During the past thirteen years the Hygienic Laboratory has examined vaccine virus sufficient for the vaccination of over 2,000,000 persons, the test being made especially to demonstrate the presence of tetanus bacillus, and in not a single instance have they been able to show the presence of the germ or its products. The virus examined included samples of the same lot of virus, in several instances, as was used for the vaccination of persons who subsequently developed tetanus. This is of special significance, for the methods for the detection of tetanus organisms has been so refined in the Hygienic Laboratory that it has been possible in practically all cases by a combination of tests to demonstrate their presence. During the ten-year period from 1904 to 1913 inclusive, approximately 40,000,000 doses of vaccine virus have been sold, and of this number 31,942,000 were not returned to the manufacturers but were presumably used for vaccination. During the same period of time only 41 authenticated cases of tetanus, developing subsequently in the vaccination, have been found. Considering the number of vaccinations, over 31,000,000, we may conclude that the infection was not in the virus, as sold, but was received in some other way.

In 5 cases of tetanus occurring in one State, it was found that 71,796 doses of vaccine virus had been sold in that State by one maker alone and probably as much or more by others. This particular manufacturer had sold, during the same period, over 209,000 doses of vaccine virus and yet no other cases of tetanus were reported among the users of that virus. In the army and navy the records show, for the ten years just mentioned, that 359,809 vaccinations were done in the army and 225,028 in the navy. During the same period there were 6 cases of tetanus in the army, in none of which was there any reason to believe that vaccination had anything to do with the infection. In the same period there were 2 cases of tetanus in the navy, neither of which had any relation to vaccination.

In regard to the cases of tetanus that have occurred following vaccination since 1904, 41 have been found in which there has been collected reasonably satisfactory data. In many of the cases studied it was found that other persons had been vaccinated with the same lot of virus at the same time, and, with a single exception, no other person suffered any ill effect. It was also found that many thousands of vaccines of the same lot of virus were used in other places and no case of tetanus followed their use. The average incubation period is, if counted from the time of vaccination to the onset of tetanus of the 41 cases,

twenty-two days. In 1902 Willson collected 52 cases of tetanus following vaccination in a period from 1839 to 1902. Forty-one of these died, 11 recovered, a percentage mortality of 78.08. Of Anderson's 41 cases, 29 died and 12 recovered, a percentage mortality of 70.7. The two together had a total of 93 cases, in which 70 died and 23 recovered, a percentage mortality of 75.2. The average of the suppositious incubation periods, counted from the time of the vaccination to the onset of tetanus in the combined series of 83 cases, all in which the record showed the time, was 20.7 days.

In 1905 Andrews and Morgan, in a series of 858 cases of tetanus, found 588 to have an incubation period of ten days, and of this number 363 were fatal, or a mortality of 61.7 per cent. There were 270 cases with an incubation period of more than ten days, 112 of which were fatal, or a mortality of 41.5 per cent. It is a well-known fact that the mortality of cases of tetanus with an incubation period of less than ten days is much higher than that of cases with a longer incubation period. The combination mortality of Willson and Anderson's cases was 75.2 per cent., which is higher than the mortality of cases that have an incubation period of ten days or less. The incubation period for the combined series, if counted from the date of vaccination, was 20.7 days. It seems very evident from these figures that the infection was received ten days or less from the onset of the tetanus and so could not have been from tetanus germs contained in the vaccine virus. In all probability the infection was received about the tenth day or later after vaccination, through the vaccination scab having been removed and the wound so left infected. In other words, the infection with tetanus after vaccination is caused by a contamination of the vaccination wound, such as may occur in the infection of any other surgical wound not properly cared for.

**Trachoma in the United States.** Up until 1897 no particular attention was paid to the problem of trachoma, but at that time, owing to the increasing number of cases applying for treatment in the dispensaries in Eastern States, the American Ophthalmological Society urged that steps be taken to prevent the further importation of the disease. In the same year the Surgeon-General of the Public Health Service called attention to the communicability of the disease, and it was classified as one of the dangerous contagious diseases within the meaning of the immigration law of 1891. Kerr[1] has made a resumé of what has been done in recent years, and some idea of the number of cases may be obtained from the figures for the past ten years. During this time nearly 12,000,000 aliens were examined, and of this number nearly 23,000 cases of the disease were discovered. This is exclusive of the number prevented embarking from foreign points, which, owing to the

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[1] Public Health Reports, August 20, 1915, p. 2437.

increased inspection, runs into many thousands each year. This restriction has had a very evident effect on the disease in this country, and Davies, of New York, found that prior to 1897 the percentage of treatment in 500,000 cases of eye disease was 4 per cent., while three years after the restriction, in 100,000 cases of eye disease, only a little over 2 per cent. were trachoma.

A certain amount of restriction has been carried on in Canada, and some effort has been made to have it prevented in the American republics.

Numerous reports have been made, chiefly by the officials of the Public Health Service, and the disease has been found to be widely prevalent, particularly among the Indians. Out of 40,000 Indians examined, over 22 per cent. were found to have the disease. In certain sections, as in Oklahoma, the percentage runs very much higher, reaching nearly 70. In a large proportion of white and colored individuals examined in various States, the percentage of infection varied from over 7 per cent. to 0.02 per cent.

The disease is found practically everywhere, but is especially prevalent in the mountain districts of Kentucky, Virginia, West Virginia, and Tennessee. A certain amount of progress has been made in the treatment of the disease, the most efficient measure being the opening of Government hospitals, three of which have been put in operation in Kentucky, one in Virginia, and one is being established in the mountains of West Virginia. Educational bulletins have been extensively used in the counties in which the work has been carried on, and this method has been supplemented by public health lectures and with visits for the purpose of instruction. In combating a disease like trachoma, it is necessary to eliminate the foci of the disease, and at the same time to educate the people, particularly the children, in the method of preventing it, but, as the disease is so largely dependent upon unsanitary surroundings, the improvement of the social and economic condition plays a very important part in the ultimate success in stamping out the disease.

**Trypanosomiasis in America.** It was interesting to note that another case of sleeping sickness has been reported in America, this time by Tuttle. The case was a negro, aged thirty-five years, who was a native of the Cape Verde Islands and was admitted to the Massachusetts State Infirmary from New Bedford in October, 1914. The patient spoke only Portuguese and it was some weeks before an interpreter was obtained to get his history. Two years before coming to the United States the patient migrated to Portuguese Guinea on the west coast of Africa. He remained there a year and a half, during which time he had a fever which lasted eight days. At the end of his stay he returned to the Cape Verde Islands together with a large number of African negroes, who, on arriving, were not allowed to land on account of some illness, the patient in question showing no signs of the disease and was

permitted to pass. Shortly after he sailed for the United States and landed at Newport, R. I., in April, 1914. From there he went directly to New Bedford. About a month later he began to sleep a great part of the time and grew gradually weaker. He presented on his entrance to the infirmary a rather typical appearance of sleeping sickness and the blood examinations being negative, a lumbar puncture was done and the fluid obtained showed numerous parasites. The patient eventually died. The chief point of interest in connection with this case is again to call attention to the necessity of bearing in mind diseases which are native to other lands.

**Typhoid Fever.** Typhoid Vaccination. For the next few years it will be exceedingly interesting to watch the progress of typhoid vaccination, both in regard to the results and also in regard to the amount of constitutional disturbance induced by the inoculation. The method naturally has come in for a certain amount of criticism and a certain amount of opposition, and failures and untoward symptoms have probably all received their due measure of attention.

Harris and Ogan[1] have detailed the experiences of the New York Health Department in typhoid immunization. In this connection it is interesting to note that the experiments along this line date from 1896, not counting the preliminary experimental work which led to the use of this method. In that year Pfeiffer and Kolle, in Germany, and Wright, in England, published the results of experiments in the prevention of typhoid fever by injections of the typhoid bacillus that had been killed by heat. As is well known, the first extensive trials made by Wright in the British Army in South Africa, while giving better results than anything heretofore suggested, were not as successful as could have been wished. Leishman subsequently used the method in the British Army in India, and determined that one of the causes, at least, of the partial failure in the South African campaign was due to the use of superheated vaccine. The vaccine used by the Department of Health in New York is similar to the one used in the army, except that phenol has been substituted for tricresol as a preservative, because of the lessened pain caused by the injection.

The authors quoted have grouped the cases that offer any atypical features into four classes:

Class 1. In which death has been attributed to antityphoid inoculation, and was really due to another cause, the prophylactic treatment being a mere coincidence.

Class 2. Severe reactions within a few hours after treatment.

Class 3. In which immunization was partial and insufficient, the patients having been long exposed, and already in a state of incubation when treatment was begun.

[1] Journal of American Medical Association, January 2, 1915, p. 3.

Class 4. In which a complete course of prophylactic treatment failed to give immunity, and was followed after a relatively short interval by an attack of the disease.

Under the first class they report 1 instance of a man, aged twenty-five years, who received three injections of the vaccine in January, 1914. Two months afterward he became ill, and the physician who attended him diagnosed his illness as influenza. Just before his death, which occurred March 30, 1914, another physician who was called in certified on the death certificate that the disease was typhoid fever. An autopsy was ordered, and it was found that the patient was suffering with a malignant endocarditis, and that there was no evidence whatever of typhoid fever.

Under the second heading of severe reactions, a number of interesting things are reported. One patient was being injected, and it was noticed that on withdrawal of the needle a free stream of dark blood followed, a vein having been punctured. Within half an hour the patient had sudden faintness, his skin became pale and clammy, complained of headache, showed a dulness of intellect, with a temperature of 103°. These symptoms persisted for a few hours, but the patient was ready to go to work the next day. It was supposed that the symptoms were caused by the entrance of the vaccine directly into the vein, but it will be noted that no lasting or serious results remained.

In some instances an urticarial rash on the chest and abdomen, lasting for a week, has been noted, and occasionally herpes facialis has been reported. In some instances, when prolonged journeys or physical exercise have followed the injection, the patients have complained of feeling very sick afterward, but this can be avoided by taking reasonable precautions. A certain number of severe reactions will follow the injection of the vaccine. This is more liable to occur in individuals weakened from some other illness, through alcoholism before or after the injection, through marked fatigue or undue exertion. Russell's figures show that 0.3 per cent. had suffered reactions after the first injection, 0.2 per cent. after the second, and 0.1 per cent. after the third. A severe reaction is one which is accompanied with a temperature reaching 103° or 104°, marked malaise, or by vomiting, diarrhea, or chills. In some instances, where the individual is infected with typhoid already, the disease may become manifest a short time after an injection of the vaccine. A few cases of this kind are liable to occur where extensive vaccination is used to stop an epidemic.

There have been a number of studies made on this subject, and while the reports are not all in accord, the majority of them are in favor of vaccinating inhabitants of any community in which typhoid is very prevalent. Cullinan, of Dublin, inoculated 500 persons in an institution during an epidemic of typhoid which had lasted five months, and only 1.35 per cent. contracted the disease, and these were already in

the incubation stage when the vaccination was made. Out of 114 inoculated nurses in the same epidemic, 14.9 per cent. developed the disease.

Spooner, in a small town in Vermont in which there were 65 persons, of whom 17 had typhoid fever, inoculated 29. Only 1, or 3.5 per cent., contracted the disease, whereas of the 19 who had refused vaccination, 5, or 26.3 per cent., developed typhoid.

In Troy, Pa., Hunt, in 1912, found 1343 persons who had been definitely exposed to the disease. Of 761 who accepted vaccination, and were well at the time of the first injection, a total of 37, or 4.86 per cent., developed typhoid fever. Of these 37 cases, 28 occurred after the first injection, 7 after the second, and 2 after the third. Of the 582 who were not vaccinated, 65, or 14.28 per cent., developed typhoid. Of the 37 cases it appears that among the vaccinated there was but 1 death, or 0.27 per cent., as opposed to 17 deaths among the 65 unvaccinated persons, or a mortality of 8.85 per cent. It is rather interesting to note that this report of Hunt's was published by one who was not enthusiastic about the results obtained. There are numerous instances in which small groups of people who have been exposed to the disease have been inoculated without any cases appearing, and Ravenel, in a small town in which an epidemic was at its height, vaccinated 116 persons, and there were no subsequent cases.

In the fourth class, the cases in which there was an apparent failure of the immunity, Harris and Ogan detailed several cases, which do not differ essentially from those noted in a special review of this subject given below. These cases probably will always occur, for, as Russell says, the immunity conferred is identical with and equal to that remaining after typhoid fever, and we all know that there are a certain number of undoubted second attacks of typhoid, and a certain number of relapses. For example, Dreschfield, in 2000 cases in Hamburg, reports that 14 were affected twice, and 1 three times. Osler studied 500 cases with reference to previous attacks, and found that 11, or 2.2 per cent, had second attacks. In regard to relapses, the percentage varies according to various observers, Murchison giving 3 per cent. and Shattuck as high as 16 per cent., and various other authors giving figures ranging between these two.

The following conclusions on the use of the vaccine will be found most useful in practice:

GENERAL CONCLUSIONS. 1. The accurate observations recorded in 100,000 of cases leave no doubt as to the preventive powers of antityphoid vaccination in all but a relatively insignificant few.

2. In those subsequently affected, it strikingly decreases the morbidity and the mortality.

3. Severe reactions, if one makes observations from extensive studies (the only correct way), are rare.

4. To avoid severe reactions one must observe carefully several precautions, as follows:

(*a*) Never administer it to any but the healthy.

(*b*) To permit of slow absorption, avoid puncture of a vein or intramuscular injection.

(*c*) Clean, syringe, and sterilize the area for injection, using tincture of iodine for the latter purpose.

(*d*) Children especially are to avoid exposure to the sun following treatment.

(*e*) Avoid administering it during the menses or pregnancy.

(*f*) Allow no hard work or indulgence in alcohol after the injection.

(*g*) Avoid reinjecting in indurated areas.

5. Severe reactions have never left permanent injury.

6. When the incubation period has begun, the time for antityphoid immunization has passed. The treatment is preventive of typhoid fever, and not a typhoid antitoxin.

7. Long exposure to overwhelming doses of typhoid bacilli (in those who are in close contact with cases, and especially in epidemics) may nullify the immunizing powers of antityphoid vaccine, and an attack may therefore follow one or more injections.

8. Chronic illness (tuberculosis, etc.), as well as debility from other causes, and fatigue and exhaustion as well, predisposes to severe reactions.

9. Injections after intimate and long exposure hasten the onset.

10. For a period of at least two years, and possibly more, immunization is as effective in protecting from an attack of typhoid fever as is a previous attack of the disease itself.

11. Recurrences may follow after a complete immunizing course of treatment, in exceptional instances in which debility and fatigue exhaust the resistant and defensive powers of the body, and when exposure to massive doses of typhoid bacilli exists.

VACCINATION IN THE PREVENTION OF TYPHOID FEVER IN THE UNITED STATES ARMY. The results obtained by vaccination against typhoid fever in the United States Army is watched with a great deal of interest, so I am including the most recent statistics which are from an article by Lyster.[1] During the summer of 1908, Russell was sent to Europe to study the methods in use in England and he subsequently recommended the use of vaccination. The vaccine, as used in the army, is made from a single strain of typhoid bacilli which was chosen because it was shown to produce a large amount of antibodies. Owing to the fact that comparatively few cases of paratyphoid have occurred in the army, the suggestion of Castellani, of using a mixed vaccine, has not been thought necessary. In 1914 there were 7 cases of typhoid, most of these cases were taken ill immediately after their enlistment, before there was time to give the vaccine. One case not having vaccine at

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[1] Journal of American Medical Association, August 7, 1915, p. 510.

all, in 2 cases one dose was given, and in 2 cases two doses were given, and 1 case received full three injections, and 1 case had been vaccinated, supposedly in 1910. Three of these cases died, 1 of which had no vaccine, the other 2 cases having had but one dose each, and in both of these cases the disease started almost immediately after enlistment. The following table shows the results that have been obtained since the first vaccinations in 1909:

VACCINATION AGAINST TYPHOID IN THE UNITED STATES ARMY.

| Year. | Number of persons vaccinated. | Number receiving three doses. | Cases of typhoid fever. | Army, mean strength. |
|---|---|---|---|---|
| 1908[1] . . . . . . . . . | 0 | 0 | 239 | 74,692 |
| 1909,[1] to September 1 . . . . | 830 | 621 | 282 | 84,077 |
| 1910[1] . . . . . . . . . | 16,093 | 11,932 | 198 | 81,434 |
| 1911,[1] January 1 to June 30 . . | 27,720 | 25,779 | 70 | 82,802 |
| 1912,[2] July 1, 1911 to June 30 . . | 40,057 | All | 27 | 88,478 |
| 1913,[2] July 1, 1912 to June 30 . . | 25,086 | All | 4 | 90,752 |
| 1914,[2] July 1, 1913 to June 30 . . | 35,902 | All | 7 | 92,877 |

FAILURE IN TYPHOID VACCINATION. The results obtained in typhoid vaccination have varied somewhat. In the United States Army the death-rate from typhoid in 1913 was reduced to zero. Typhoid vaccination is compulsory, and the men live under conditions which reduce chances of infection to a minimum. In the earlier use of the typhoid vaccine two injections were used in place of three, which did not give as good protection as the present method, and there are factors which would seem to enter into the production of an imperfect immunity, and these cannot always be avoided. The vaccine may not be satisfactory to start with, or it may be deteriorated from exposure to too high a temperature, or from using it after it has been kept too long, and there may be faults in the technic of administration, which are chiefly using an incorrect dosage, and not spacing the doses at proper intervals.

The results of vaccination have been so remarkable that it is interesting to note instances in which it has failed to give complete protection. This has been found in army statistics coming both from Germany, as in the Herero campaign in Southern West Africa in 1904, and also from British Army figures from India.

Trowbridge, Finkle, and Barnard[3] have reported an epidemic which occurred in the Minnesota School for Feeble-minded and Colony for Epileptics. In making Widal reactions on the inmates, it was found that 28 gave a positive reaction, and 8 of these were found to be active carriers.

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[1] Voluntary.　　　　　　　　　　　　　　[2] Compulsory; fiscal year.
[3] Journal of American Medical Association, February 27, 1915, p. 728.

To prevent the development of the disease, some 1500 patients were inoculated in the usual manner. Some three months after the completion of the inoculation several cases were admitted to the hospital, with the diagnosis of typhoid, and the diagnosis was confirmed by blood cultures, and in 1 instance by autopsy. Altogether 57 cases were diagnosed as clinical typhoid, 46 being inmates, and the remainder employees. Of the 46 patients, 39 gave positive Widals, 1 gave an atypical reaction, and 2 agglutinated with the paratyphoid. In 3 cases the reaction was negative.

A study of conditions revealed the fact that the milk supply of the hospital was badly contaminated, and the epidemic was cut short by sterilizing the milk. In this community the vaccine used was prepared by the State Board of Health of Minnesota, and, as far as could be determined, had been properly cared for.

The authors conclude from their studies that typhoid fever may be contracted by individuals who have received the prophylactic treatment, and who subsequently show a positive Widal reaction. In their experience, the course of the disease was not appreciably shortened in the vaccinated individuals, but the mortality was markedly reduced, and the protected persons also showed fewer of the classical symptoms of the disease. They also agreed that the development of paratyphoid is not prevented by the use of the typhoid prophylactic. They regard the Widal reaction as of uncertain value as a criterion of the presence of immunity.

The above epidemic may have been caused by the patients being exposed for a long period of time to the use of milk containing very large quantities of virulent typhoid bacilli, but it is also possible that some of the vaccine used was not up to the standard. The authors do not state the number of injections given, nor the size of the dose used. They merely state that the dosage and time interval, as recommended by the State Board of Health, were adhered to, except that the first injection was three-quarters of the amount usually recommended.

TRIPLE INFECTION OF TYPHOID—PARATYPHOID A AND PARATYPHOID B. Castellani[1] has reported a case of triple infection that came under his observation and which he regards as an additional argument for the use of mixed vaccines. The patient was a man, aged fifty years, who was taken ill in January, 1914. In the beginning he felt indisposed, was weak, and had fever. He was given quinine without any effect and Castellani saw him the end of the month. At this time he had a temperature of 102° F., coated tongue, slight meteorism, a scarcely palpable spleen, and no rose spots. In the course of the disease the patient had grave hemorrhages, two relapses and a very intense cystitis, but was regarded completely cured in April, 1914. Repeated examina-

[1] Journal of Medicine and Hygiene, February 15, 1915.

tions of the blood showed there was positive agglutination for typhoid 1 in 80; paratyphoid A 1 in 60; paratyphoid B 1 in 80. Circumstances were such it was impossible to make blood cultures. Studies were made of the feces. At one time they isolated the bacteria of typhoid together with the paratyphoid A and the paratyphoid B, on the second and third examinations, the typhoid and paratyphoid A. From the urine they isolated only the typhoid and the paratyphoid B. The presence of specific agglutinating substances in the serum of the patient for the three varieties of bacilli and their isolation from the urine and the stools seems to make the evidence complete that the case was one of a genuine triple infection.

MIXED TYPHOID VACCINES. There have been numerous suggestions and a certain amount of experimental work on the subject of the use of a mixed vaccine, that is, one containing typhoid, paratyphoid A, and paratyphoid B. Various objections have been urged against using such mixtures, one being that the immunity produced from typhoid would be less, and that owing to the fact that both of the paratyphoid diseases are of less importance, it would be a mistake to run the risk of not producing as perfect an immunity against typhoid as possible.

One of the chief exponents of this method is Castellani, of the Institute of Pathology at the University of Naples. He[1] has published numerous contributions, beginning as early as 1902. He has recently given directions for the preparation of the vaccines that he has found satisfactory. He suggests either the use of a vaccine killed by heat, or one in which the germs are killed by carbolic acid. The cultures are grown in the usual manner in bouillon, incubated at 37° C. for eighteen hours. The bacilli are then counted, and diluted to bring the number down to 1,000,000,000 per c.c. If the germs are very motile, they are mobilized, as suggested by Leishmann, by adding a trace of formalin. The culture is then kept for an hour in a water-bath at 53° C. The mixture is made in the proportion of two parts of typhoid, one part of paratyphoid A, and one part of paratyphoid B. When this mixture is cooled, 0.25 per cent. lysol is added, and the mixture shaken thoroughly. The mixture should be tested twelve hours later for sterility, and each c.c. will contain 500,000,000 typhoid germs, 250,000,000 paratyphoid A, and 250,000,000 paratyphoid B. The first injection consists of 0.5 to 0.6 c.c., the second, given a week later, of 1 to 1.2 c.c., and if a third is given, a week later, the same dosage should be used as for the second injection.

The vaccines which are not heated are prepared by making the same mixture, but in this case agar cultures twenty-four hours old are used, and the growth is washed off with a sterile 0.85 per cent. salt solution, to which is added 0.5 per cent. carbolic acid. This is kept for twenty-

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[1] British Medical Journal, May 1, 1915, p. 758.

four hours at room temperature, and then tested for sterility and stand-ardized, and the mixtures are made in the same proportion as for the heated vaccines.

Castellani claims that these mixtures will not give any severer reaction than the simple typhoid vaccine, and the inoculated persons develop protective substances for the three diseases. He believes that in countries where the three diseases are prevalent, that this is a much better procedure than the use of the simple typhoid vaccine.

Another contribution on the same subject has been made by Dreyer, Walker, and Gibson,[1] in which they urge the necessity of classifying the cases returned as enteric fever, in accordance with the results of detailed bacteriological examination, with particular reference to the differentiation between typhoid and the paratyphoid. In addition to this, they lay particular stress upon the necessity for prophylactic vaccinations against paratyphoïd, which, according to their observation, have been increasing. After detailing their method of diagnosis, they give the results of their experimental work. They believe that the bacillus which exhibits the greatest agglutinability may be regarded as the infective agent, or at any rate as the principal infective agent, when the case under examination shows that both typhoid and paratyphoids react. If the case is one in which the agglutination of a second micro-organism is due to the presence of coagglutinins, the curve of the agglutination will be found to run parallel to the curve of principal agglutination, but at a lower level. If the case, on the other hand, is one of mixed infection, with two different organisms, their respective curves of agglutination are not parallel, but exhibit totally independent courses, which may even cross one another. They have demonstrated from their studies that no case of typhoid fever has been found among the antityphoid inoculated individuals that came under their observation. Of 6 cases of paratyphoid infection, 3 occurred in subjects who had previously had the antityphoid vaccination. Had these cases been returned as cases of typhoid fever, the value of antityphoid inoculation apparently would be greatly diminished. As far as their limited series of cases goes, paratyphoid fever has occurred with equal frequency among those who had the antityphoid inoculation and non-inoculated individuals. This is in agreement with the findings of Kabeshima, whose studies were made in the Japanese Navy. Kabeshima states emphatically that antityphoid inoculation affords no appreciable protection against paratyphoid infection.[2] In no case other than a case of active paratyphoid infection has the serum of the patient agglutinated, either with paratyphoid A or B in a dilution of 1 in 25, even when the titre of typhoid agglutination was very high, and this statement holds

[1] Lancet, February 13, 1915, p. 324.
[2] Centralblatt f. Bakteriologie, I Abt., Originale, June 13, 1914, p. 294.

good, both for antityphoid inoculated individuals, and for non-inoculated persons suffering from typhoid fever. The typhoid agglutination found in convalescents from typhoid fever is easily distinguished from that of inoculated individuals. With very rare exceptions, it is of low titre contrasted with that of persons recently inoculated whose typhoid agglutination titre remains high. Secondly, it will always show a measurable diminution of titre in the course of a week or two, while in antityphoid inoculated individuals, whose titre has by lapse of time fallen to a similarly low level, no measurable change will be found within the same period.

The results of Kabeshima are of considerable interest, inasmuch as he has used a mixed vaccine containing equal parts of typhoid, paratyphoid A, and paratyphoid B, on about 12,000 men. In the period from 1909 to 1911, in five naval hospitals, the following results were noted:

| Disease. | Total numbers of cases. | Cases in inoculated subjects. | | Cases in non-inoculated subjects. | |
|---|---|---|---|---|---|
| | | Sick. | Dead. | Sick. | Dead. |
| Typhoid | 367 | 68 | 5 | 299 | 40 |
| Paratyphoid A | 289 | 71 | 2 | 218 | 5 |
| Paratyphoid B | 447 | 0 | 0 | 447 | 0 |

THE USE OF AUTOGENOUS LIVING VACCINE IN THE TREATMENT OF TYPHOID. A preliminary report on this subject has been made by Bourke, Evans, and Rowland.[1] Their previous experience with the use of vaccines in the treatment of typhoid led Rowland to try the use of the living bacilli. Their first report is based on only 6 cases, and their procedure is of considerable interest. In each instance the diagnosis of the disease was made by means of blood culture. The culture was obtained, was verified, and kept going by daily inoculation in ordinary blood-culture media. The age of the culture used was generally eighteen hours, and the number of bacilli used varied between 60,000,000 to 300,000,000. The vaccine was injected subcutaneously, as a rule in the pectoral region. This was followed by a very slight local reaction and a marked general reaction, this consisting of a sharp rise in temperature, and was frequently followed by profuse perspiration. Following this, the temperature usually fell to below what it had been running. Three or four injections were generally given four to six days apart. Following the reaction, the patient's general condition was always much better, and the course of the disease was possible somewhat shortened.

THE VACCINE TREATMENT OF TYPHOID FEVER. Numerous attempts have been made in the past few years to utilize typhoid vaccines in the treatment of the disease. In some instances the reports have been decidedly favorable, but it must be remembered that the mortality in

[1] British Medical Journal, April 3, 1915, p. 584.

various epidemics of typhoid fever varies considerably, and too much stress should not be placed upon scattered reports.

Watters has collected reports from 1120 cases treated with vaccines, and he believes that the mortality is lowered slightly, the duration of the fever averages ten days less, and that the percentage of relapses is lowered. In a general way the patients were not as depressed, not so toxic, and the temperature ran a somewhat lower course than is met with in untreated cases. In this series the ordinary vaccines were used, that is, bacilli killed by heat, and the injection was made subcutaneously. No harm seems to have resulted from the injections, and curiously enough, there did not seem to be very much difference whether large or small doses were used.

A report of remarkable interest is that of Ichikawa.[1] He used intravenous injections of sensitized bacteria. Living bacilli were treated with serum from typhoid convalescents. These were washed, and a suspension made in salt solution, with a small amount of phenol added. His results were so remarkable that a similar investigation should at once be undertaken.

Following a slight rise in temperature, there was a fall to normal and a rapid diminution of all symptoms.

Kraus has made a somewhat similar report on the intravenous injection of vaccines. The explanation given is that in typhoid fever, but small amounts of antibodies are produced, and by the injection of a large number of sensitized bacteria, a large amount of antibodies is formed, with the result of killing the bacteria. When injected subcutaneously, the absorption is so slow as not to result in the formation of sufficiently large quantities of antibodies to produce the desired effect.

Goldscheider and Aust[2] have made a short report on their experience of this method of treatment in cases of typhoid occurring in the German Army. The dosage which they used consisted first of 250,000,000 bacilli which was later raised to 500,000,000 and in some instances to 750,000,000. The results with the larger doses were very much more satisfactory. The charts in which they illustrate their article show two types of curves—one in which there is a definite drop in the temperature, the temperature reaching normal after two or three days following the injection, and in other cases there was a marked remission, the temperature falling either to normal or to near it after a period of two days and then rising, reaching a point somewhat lower than that noted at the time of the injection after a period of usually three days. In the severest cases and in the cases which show a tendency to persist, they preferred to use small doses, whereas in the lighter forms, when there is a tendency

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[1] Zeitschrift f. Immunitätsforschung und experimental Therapie, 1914, xxiii, 32.
[2] Deutsche medizinische Wochenschrift, March 25, 1915, p. 361.

to remission or in cases showing a remittent type of fever, they recommend larger doses.

There has been considerable work done in Italy in the treatment of typhoid by means of vaccines. Pensuti[1] has contributed an article detailing his personal experiences and without going into the details of his cases it may be stated that he believes that the vaccine therapy of typhoid is undoubtedly of value and that it may be regarded as a specific in the disease. Results which have not been as favorable as they should be are probably due to a lack of opportunities of just how to use this method of treatment. On the other hand, Bocelli[2] has used various methods, including the vaccine of Löffler intravenously, and the vaccine of Pfeiffer-Kolle, and the sensitized vaccine of Besredka subcutaneously, and, in his hands, in the course of an epidemic, he did not find that it shortened the disease or lessened the severity of it. In view of the fact that other observers have obtained such favorable results, he will continue his observations, hoping for more favorable results in the future.

INTRAVENOUS INJECTIONS OF TYPHOID VACCINE. Reibmayr[3] has reported his experience with the intravenous use of typhoid vaccine in the treatment of typhoid fever. The vaccine used was killed with carbolic acid and each cubic centimeter contained 500,000,000 bacilli. Of this, the dosage varied between 0.5 and 1.2 c.c. Injections in each case were given in the veins of the arm. In the majority of cases, though not in all, there was a sharp reaction beginning one-half to three-quarters of an hour after the injection. This consisted of a chill, sometimes light and sometimes very severe, lasting from thirty to forty-five minutes. The temperature rose rapidly and remained high from five to twenty-four hours, then dropped to normal and in some cases to subnormal. With the drop of the temperature there was marked sweating. During this period the patient complained of feeling weak and tired, but there was usually no pain. In all, 68 patients were treated by this method —in 41 there were marked results and in 14 of these the temperature remained low, and after one or two days passed into the stage of convalescence. In the other cases the temperature returned, but the course of the disease seemed to be shortened. In the remaining cases the injections were without any effect whatever.

THE USE OF ALBUMOSE IN THE TREATMENT OF TYPHOID. Various substances have been used intravenously in the treatment of typhoid fever. In the Argentine Republic, Panna, Torres, Dessy, and others have used killed typhoid bacilli or extracts made from them, and Moore, Schulz, and Ditthorn have tried the same method in Germany. These injections were followed by a rise in temperature with an accompanying

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[1] Il Policlinico Sezione Medica, February 1, 1915, p. 49.
[2] Il Policlinico Pratica, August 1, 1915, p. 341.
[3] Münchener medizinische Wochenschrift, May 4, 1915, p. 610.

chill, followed some hours later by a fall in temperature, a subsequent lowering of the temperature and a more rapid recovery than would otherwise have been expected. Following this idea, Kraus and Mazza found that by the injection of killed bacteria of other kinds the same results could be obtained. They used killed colon bacilli. Forscher also discovered that intravenous injections of vaccine prepared from the colon bacillus and also typhoid vaccines cause a fall in the temperature. Lüdke,[1] found that not only killed bacteria would produce this result but artificial protein substances, particularly deutero-albumose, gave the same results. He tried this method in 22 cases, giving 1 c.c. of a 2 or 4 per cent. solution of the deutero-albumose. Only typhoid cases of the average and severe type between the eighth and the twenty-first day from the beginning of the fever were treated. Of these, 7 cases showed a critical fall in the fever and the recovery took place without any further complications, the temperature reaching normal two or three days after the injection. In 9 cases the disease was shortened, lasting from five to eleven days after the injection, in 3 cases no results were observed and 1 case died from a severe typhoid sepsis. There were no bad effects observed from the injection. In 1 case in addition to the above the same strength in injections of Witte peptone was used without any appreciable results. Lüdke believes that this method of treatment is worth further study.

THE TREATMENT OF TYPHOID BY INJECTIONS OF HORDENINE. In 1906 Léger isolated an alkaloid from barley. This preparation has been carefully studied by Camus who found that it possesses some definite heart stimulating properties. Mercier and Causse-Ratuld[2] have used this drug in the treatment of some 25 cases of typhoid. It was administered in the form of a solution of sulphate of hordenine in normal salt solution of the strength of 5 parts in 1000. This solution was injected intravenously and was very well borne in doses of 48 c.c. which represents 0.24 gram of the active salt. The total daily dose never exceeded 75 c.c. The injections were followed by an immediate reaction which consisted of a sense of heat and occasionally of dyspnea, with interrupted inspirations. A later reaction consisted of a slowing of the pulse which became more regular and stronger and larger in volume. There was, however, no appreciable elevation of the arterial tension. There was a very definite improvement in the general condition, particularly with reference to the nervous system, the general typhoid state was lessened, and the sleep became more normal. There was also a very definite improvement in the digestive organs, a lessening of the pains and discomfort in the abdomen and of the diarrhea, and an improvement in the condition of the mouth. The authors believe that this

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[1] Münchener medizinische Wochenschrift, March 9, 1915, p. 321.
[2] Bulletin de l'Académie de Médecine, June 1, 1915, p. 61.

drug is one of the best stimulants that can be used in grave cases of typhoid, as it acts with great rapidity and is but very slightly toxic.

AUTOGENOUS SEROTHERAPY IN TYPHOID FEVER. The modern researches in the infectious diseases has been directed toward finding specific therapeutic procedures whereby the natural antibody formation will be increased or otherwise supported. This has been done through two methods, one the active immunization or the introduction of the specific bacteria or their products into the body, or through immunization or the introduction into the body of serum-containing antibodies formed in animals. A remarkable fact in connection with this method of treatment and one which is difficult to explain, is why the body which contains an enormous number of living germs shold have its antibody-forming powers so greatly stimulated by relatively small numbers of bacteria injected subcutaneously, or that the disease should be so favorably influenced by comparatively small amounts of immune serums. There are a number of interesting observations that have been made in this connection, and Pfeiffer was of the opinion that the material to which the serum owed its antagonism to the bacteria was contained in the blood plasma and only becomes formed after the coagulation of the blood. He also believes that the bacteriolysins work in the same manner as a ferment, so that starting with small amounts the effect is more or less continuous.

Various attempts have been made to treat typhoid fever by means of the serum from convalescent patients, and as early as 1893, Hammerschlag tried this method without success, as did subsequently von Jaksch, Pollock, and Jez. Other observers, as Weissbecker, Walder, and Walker, claim to have obtained good results. These observations are somewhat doubtful. Wassermann thought that the failure to obtain better results was due to the presence of a complement in the serum, and suggested the addition of fresh complement containing beef blood. Marx, however, was of the opinion that the use of so large a quantity of heterologous serum was impracticable. In more recent years this method has naturally fallen into disuse.

Koenigsfeld[1] has reported the results of some observations. He is of the opinion that the best results in immunization are to be obtained by antibodies that are not only of the same kind of bacteria but, indeed, from the specific strain which is causing the disease. The ideal method of obtaining serums would be to immunize animals with the specific bacteria taken from the patient. With the present limitations of the technic, this is not possible. Koenigsberg suggests a very simple method whereby he believes that the same end-results may be attained. It is possible to demonstrate the presence of the specific antibodies in the blood of the typhoid patient, particularly if the patient has been

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[1] Münchener medizinische Wochenschrift, February 23, 1915, p. 253.

ill at least eight days. He suggests the use of the serum from the patient, the technic of application being extremely simple. From 50 to 60 c.c. of blood are withdrawn from a vein into a sterile vessel and immediately placed upon ice. After several hours the serum may be poured off and to this is added, drop by drop, 10 per cent. of a 5 per cent. phenol solution. The serum is then ready for use. Injections are to be made subcutaneously. From 2.5 c.c. to 4 c.c. of serum is injected at a time, so that from the blood obtained from one bleeding the treatment may be continued four, five or six days. If more is necessary, the procedure may be repeated. Eighteen cases have been treated by this method, 14 improved in a very short time, and 3 patients died. Two fatal cases were complicated by severe gunshot wounds, and the third was admitted in a comatose condition, with extremely bad heart action. The good effects of the treatment are regularly noted in a few days. The period of fever is shortened, and, if the treatment is begun at the fastigium, only from two to five injections are needed for the temperature to pass into the stage of long variations, and this is usually shortened to two or three days, and in the next few days the temperature reaches normal. The pulse becomes better and the general condition of the patient is always very much improved. In severe comatose patients, after two or three injections the patient's mind becomes clear, the appetite returns, the diarrhea stops, and the diazo-reaction disappears from the urine. In 2 instances there was a sudden fall in temperature with a weak pulse. This was treated by injections of camphor, and disappeared promptly without any untoward results. In a disease like typhoid the results of any specific treatment cannot be ascertained by so short a series as 18 patients, but, if the improvement noted by Koenigsberg can be obtained by subsequent workers, this method may furnish the starting-point for studies along a new line.

TYPHOID CARRIERS. The history of some of the typhoid carriers has become almost classic. Typhoid Mary, of New York, is a national character, and H. O. has attracted almost as much attention on the other side of the continent. In PROGRESSIVE MEDICINE in March, 1913, page 213, I referred to Sawyer's report of this individual who had typhoid in 1907 and since that time has served on five different ships with the result that he caused 21 cases of typhoid and 4 deaths. Most of these cases occurred on the steamship "Acme." Subsequently, Currie and McKeon[1] made a study of this case and they were able to isolate the typhoid bacillus from the feces on twelve different occasions. An autogenous vaccine was tried in 1912 in ten doses, increasing 25,000,000 to 1,500,000,000. From June 19 to October 14, 1912, the stools were free from typhoid bacilli. He was kept under observation and finally discharged from the hospital with an agreement to report for examination once a month for six months.

[1] Journal of American Medical Association, January 18, 1913, p. 183

He was employed from October 20, 1912, to about January 10, 1913, as winch driver on the steamer "Novo." On November 15, 1912, a seaman from this vessel was admitted with typhoid and subsequently 2 others were infected, 1 of whom died. H. O. was suspected of being the cause and was discharged and there were no further cases of typhoid on the ship.

Some of the examinations made failed to reveal the typhoid bacillus, but, on January 28, 1913, it was again found. The gall-bladder and its duct was then removed. The gall-bladder contained no gall-stones and was normal. It contained no typhoid bacilli, although colon bacilli and a few other organisms were present. Frequent examination of the feces were made after the operation and these were negative until April 8, 1913, when the typhoid bacillus was again found. From this date until April 7, 1915, a period of two years, 71 examinations were made and typhoid bacillus were found in only three specimens, on November 28, December 5, 1913, and February 11, 1914. Subsequently, Wayson suggested using the method of Carnot and Weill-Halle of obtaining bile from the stomach.

This was done by administering 150 c.c. of olive oil on an empty stomach and the stomach emptied one hour later through a stomach-tube. The material so obtained was allowed to stand and the lower layer removed for examination. The examination made on January 26, 1915, did not show any typhoid bacilli, but an organism was isolated which resembled the paratyphoid A. On March 16, 1915, the typhoid bacillus was demonstrated in the stomach contents. The stools at this time were negative. On April 12, 1915, he was given podophyllum in the evening and magnesium sulphate in the morning. The typhoid bacilli were then again demonstrated.

The history of this man shows that there are certain carriers that persist over long periods of time, who are a great menace to the community and who should be under some form of supervision, if not actually quarantined. The problem of freeing the typhoid carrier from typhoid bacilli is one that has received altogether too little attention, but it is to be hoped that untried methods may be more availing than the means usually employed.

**Typhus Fever.** After having practically disappeared, at least from the civilized portion of the world, typhus fever as a severe epidemic disease has again come to light, and is the subject of a considerable amount of discussion, owing, first, to the devastating epidemics in Serbia and Austria, and perhaps in other countries in which the war is going on, and also to the brilliant studies of Plotz, of New York, noted below. Those interested in the history of the disease will find a short article by Vaughan[1] worth reading.

[1] Journal of American Medical Association, May 29, 1915, p. 1805.

The very earliest records of the disease are, of course, very uncertain, inasmuch as many of the epidemic diseases were not distinguished one from the other. Hippocrates, in his book on epidemics, reports some cases which clinically bear a very close resemblance to typhus. In the early period, the disease was probably confused with epidemics of plague. Toward the close of the fifteenth century, in the siege of Granada, there was a severe epidemic, which carried off some 17,000 soldiers, and this was called tabardillo, on account of the spots appearing on the skin. This term is still one of the Spanish names for typhus fever, but in recent years, particularly in America, has been restricted to a somewhat milder type of the disease seen in Mexico. In the sixteenth century, Fracastorius and Cardanus both gave clear pictures of the disease, and since that time there have been numerous descriptions, all paying considerable attention to the eruption, and many of the names being derived from this one feature—the so-called petechie of the Italians, la pourpre of the French, the Fleckfieber of the Germans, and the spotted fever of the English.

The disease has always been associated with overcrowding, with poverty, with war, and with famine, and some of the descriptions are extremely vivid and distressing. A curious fact which has been noted many times in Irish epidemics is that the case mortality is higher among the robust and well-fed than among the weak and hungry. Creighton, writing of an Irish epidemic, stated, "there appeared to be a scale of malignity in the fevers in an inverted order of the degree of misery. The most wretched had the mildest fever, the artisan or cottagers had typhus in the usual fatal proportion, the classes living in comfort had typhus of the very fatal kind."

In this country, typhus fever in the mild and attentuated form described by Brill, and generally referred to as Brill's disease, has been reported from New York, Boston, Chicago, Atlanta, Milwaukee, Indiana, Virginia, and Washington, D. C., and it probably exists throughout the United States unrecognized, because it is not thought of as a clinical possibility. Recently, the disease has been reported in Minneapolis by Head.[1] It would be an extremely interesting thing if all cases observed could be reported to the medical journals for several years, in order that the question of clinical appearance might become firmly impressed upon the minds of the American profession.

The case reported by Head occurred in a Jew peddler, aged fifty years, who was seen in May, 1914. He had been healthy all his life up to two weeks before the present illness, when he had headache and loss of appetite. A week later he began to have fever, more intense headache, some nausea, and became so weak he could not work. When first seen he had a temperature of 102°, was considerably prostrated, but with

[1] Journal of American Medical Association, March 20, 1915, p. 991.

no distinctive symptoms. Two days later he had a temperature of 103°, was dull and apathetic, with a badly coated tongue and rapid pulse, and a fine, submerged, dusky red, maculopapular rash, most marked over the chest, abdomen and shoulders, and not noticeable on the face. There was no diarrhea or cough, no vomiting or nosebleed, and no rose spots present. The spleen could not be palpated, and the Widal reaction was negative. During the succeeding days the fever remained high, and the mottling of the skin became more marked, and spread over the body. There were no clinical findings of any importance outside of the rash, which looked not unlike a luetic roseola, and in certain areas, particularly over the chest and abdomen, there were fine raised, rose-colored spots, not unlike those of typhoid fever. They were more bluish in color than rose spots, and disappeared only on prolonged, firm pressure. There was no rash on the face or legs.

During the next few weeks the patient lay in a dull, stuporous state, with at times a muttering delirium. The fever was high and sustained like that of pneumonia, but repeated lung examinations were negative. The rash eventually came out over the arms, extended to the wrists and hands, and down on the upper part of both thighs. The remainder of the legs remained free. For a number of days the patient lay in a low, unconscious, typhoidal state, with incontinence of feces and urine. Three Widals made at different times were negative, and a Wassermann test for syphilis was negative. The leukocyte count on the eighth day was 5300, and on the fourteenth day, 6630. A blood culture taken on the tenth day was negative. The urine contained albumin and casts. The differential count made on the ninth day showed polynuclears 65.5, small mononuclears 26, large mononuclears 6, eosinophiles 0, transitionals 2.5.

As the disease progressed, the rash became darker, more bluish, almost purpuric. The patient gradually recovered, the rash faded, the fever disappeared gradually, and convalescence was established about the eighteenth day.

THE ETIOLOGY OF TYPHUS FEVER. The history of the investigation of the cause of typhus fever is one of the most interesting chapters in in medical history, and a large number of different organisms of various kinds have been described. These have included bacilli, cocci, spirillæ and protozoa. No one of these, however, has ever stood the test of subsequent investigation. Three different types of the disease have been studied, the typical typhus has been the object of the consideration of the European observers generally. In America, part of the work has been done upon a mild form described by Brill, and also upon tabardillo or Mexican typhus. Anderson and Goldberger have shown that the blood from cases of Brill's disease was infective for monkeys, and after these animals had reacted to it, they were found to be immune to inoculation with the blood from cases of Mexican typhus, and if the

blood from Mexican typhus was used first they could not be infected with the blood from cases of Brill's disease.

Moczutkowski, in 1900, inoculated himself with blood from a case of typhus fever, and after an incubation period of eighteen days, he developed typical symptoms of the disease. This proved that the virus existed in the circulating blood, a fact which was confirmed by the subsequent experiments of Otero and of Yerson and Vassal on human beings, and the animal experiments of Nicolle, Anderson, and Goldberger, Ricketts and Wilder, Gavino and Girard, and McCampbell. The experiments of the above observers on animals all pointed to the fact that the virus of typhus fever is non-filterable and that if this was the case, it should be something of a microscopic size. The only evidence of any value to the contrary was the single questionable experiment of Nicolle which neither he himself nor the other observers were subsequently able to confirm. This experiment consisted of inoculating a monkey with filtered serum. There was a slight rise of temperature between the sixteenth and eighteenth days, and the animal did not react to further inoculation with typhus blood. Monkeys are frequently immune to typhus, and this probably explains the failure of the monkey to react.

Ricketts and Wilder, in 1910, described a bacillus which they found in blood smears stained with the Giemsa method. Whether or not this organism is similar to the one described by Plotz, Olitsky, and Baehr, cannot be determined. Various observers have described similar organisms both Gram-negative and Gram-positive in the blood of typhus fever. Some of the observers thought that since the disease had been proved to be carried by insects, it would be found to be caused by some form of protozoa, but Ricketts and Wilder, called attention to the fact that there were diseases of bacillary origin, such as the plague, transmitted by insects. They also called attention to the fact that typhus fever is an acute, self-limited disease and that one attack confers immunity. All of these things are frequent characteristics of many bacterial diseases. These four points, that the virus is present in the blood during the febrile stage, that it is non-filterable and of microscopic size, and most probably of bacterial origin, led to many studies of the blood. Anderson and Goldberger, and Ricketts and Wilder used the various aerobic methods of culture with uniformly negative results. Over 300 cases of endemic typhus, or Brill's disease, have been studied with these methods in the laboratories of the Mt. Sinai Hospital, and the results were all negative.

Plotz repeated the work of other observers, including the method of Rabinowitch, who reported that he had obtained cultures by the use of a special medium, but the results were all negative. He also used anaerobic methods which curiously enough had apparently not been

tried by other workers. At the time of his report[1] he had studied 11 cases of European epidemic typhus, and 40 cases of the local endemic form. Most of the epidemic cases occurred in individuals returning to America after the Balkan wars. The first successful results were obtained by using Noguchi's method suggested for the cultivation of spirochetæ. This consists of an ascitic fluid-kidney-tissue medium covered with liquid petrolatum. Subsequently serum glucose agar, as suggested by Libman, was employed by the Liborius-Veillon method. The colonies usually appear in the lower 2 or 3 cm. of the tube, as a small opaque spot. These are best seen by direct sunlight or the incandescent electric light with a frosted bulb. The organism is a small, pleomorphic, Gram-positive bacillus and it is non-motile, non-encapsulated and acid-fast. Most of the organisms are straight, but some are curved and vary in length from $0.9\mu$ to $1.9\mu$. Coccoid forms also occur. The organism does not produce spores, but polar bodies are occasionally seen at one or both ends of the bacillus. It is killed by exposure to 55° C. for ten minutes. It can be grown also upon some of the other bacterial media by using strictly anërobic methods. In the original article very complete details are given concerning the cultural facts.

The general results of the blood culture studies are interesting. In the epidemic form cultures were made in 7 cases during the febrile stage of the disease and in every case the bacillus was isolated in pure culture. From an eighth case blood was inoculated intraperitoneally into two guinea-pigs, both of which developed the typical febrile reaction and at the height of this reaction a bacillus was obtained from the blood. The cases of the endemic form of the disease did not yield as many positive results, only 18 out of 34 showing the bacillus. The cultures were made at various times during the course of the disease up to and including the day of the crisis. The blood cultures made after the crisis from 6 cases of the epidemic form were all negative. In 3 of these cases the organisms had been found during the febrile period. In the endemic, 9 attempts were made after the crisis and 2 of these were positive, 1 two, and the other thirty-six hours after the crisis. These findings are all interesting, inasmuch as the authors quoted, as well as Anderson and Goldberger, have found that the blood of an infected animal is still infectious thirty-two hours after the crisis.

As a matter of control, a similar blood-culture technic was used on 198 febrile cases representing a great variety of conditions such as are seen in general hospital practice. In none of these cases was an organism recovered which in any way resembled bacilli isolated from the cases of typhus fever. The organisms from cases of endemic typhus were carefully compared with those from cases of epidemic typhus and in every instance they were found to be identical. In every case pains

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[1] Journal of Infectious Diseases, July, 1915, p. 1.

were taken to see if there were any slight differences, such as exist between typhoid and paratyphoid bacilli, but in no instance could any difference be determined. Similar studies were made of organism obtained from the blood of eight guinea-pigs and one monkey in which the disease had been produced experimentally with virus obtained from Anderson and Goldberger, and these organisms were also found to be identical with those from human cases of the disease. The use of blood cultures for diagnostic purposes is only of the confirmatory value, inasmuch as the colonies grow so slowly that the results are only known after the termination of the illness. In 87.5 per cent. of the 51 cases studied the clinical diagnosis was confirmed by blood-culture agglutination or the complement-fixation tests. On the other hand, in 2 cases in which the diagnosis had been overlooked, the positive blood culture first called attention to the nature of the disease. In both of these cases the temperature, which had been high on admission, fell suddenly to normal and a tentative diagnosis of inflenza had been made. At the suggestion of Dr. William H. Welch, the organism has been named the Bacillus typhi-exanthematici, the name which was applied by Klebs, in 1891, to a hypothetical organism in typhus fever.

The serological studies were made by Olitsky. Inasmuch as the bacillus in question is an obligatory anërobic organism, it was necessary to modify the usual serological methods in order to overcome certain difficulties, and some of the reactions could not be made at all. The serological studies demonstrated early in the course of the work that the organisms from the endemic and the epidemic forms were identical, and definitely established the fact that the organism was clearly associated with the etiology of typhus fever. The complement-fixation tests were made with three different antigens, one of the organisms of endemic cases, one from epidemic, and the third a mixture of both organisms. Later in the work it was found that the antigen made of mixed strains gave more uniform results. Forty-five cases were tested, 11 of the epidemic and 34 of the endemic typhus. The reaction is not found very often before the crisis. At the time of the crisis it is somewhat more frequently positive, and in the postcritical stage, something over 70 per cent. of the cases give positive reactions. The complement-fixing antibodies reach their maximum between the second and twelfth day after the crisis. Their presence was studied in 2 cases, in 1 of which the reaction became negative between the sixty-fourth and one hundred and thirteenth day after the crisis, and in the other case between the third and thirty-ninth day after the crisis. One hundred and four control cases were studied, with negative results. Tests were also made with antigens of various bacteria, such as the Bacterium coli, Staphylococcus aureus and various forms of streptococcus, and these were negative. The agglutination reactions were found to be better when studied microscopically than by the macroscopic method. The reactions in 1 to 50

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or higher were considered positive and the bacilli from epidemic typhus clumped with the serum from the endemic form, and the reverse was also found to be true. More positive reactions could be obtained when a mixed agglutinin was used. 90.8 per cent. of the cases tested were found positive during some period of the disease. The agglutinins evidently follow a curve similar to the complement-fixing antibodies. The maximum concentration developed about four days after the crisis. The agglutinins have been demonstrated as long as five months after the crisis. Ninety-six control cases were studied, and 7 of these gave an agglutination in dilution of 1 to 20, but not in high dilutions. In all of these 7 cases, the complement-fixation gave a negative result. On account of these findings, only serums that gave agglutination in dilutions of 1 to 50 or over were considered positive. Agglutination tests made with a large number of other bacteria were all negative. The precipitation reactions, studied in 10 cases at the height of the disease, were all negative. In 3 cases tested at the crises, 1 showed distinct clouding in 1 to 1000 dilution, while 14, or 73.6 per cent. of 19 cases tested in the afebrile period, gave precipitation of 0.5. With each there was a control test, and all of these were negative. The precipitin formation is evidently absent at the height of the disease, but becomes evident at the crisis and continues to increase until well along in the postcritical stage. Serological studies were also made in animals, and six monkeys that reacted to the typhus virus. Both complement-fixation and aggluntination tests were positive in 5, or 83.3 per cent. Agglutination and complement-fixation reactions, while often appearing in connection with immunity, are no indication of immunity. Guinea-pigs were found to be immune after reacting to typhus virus, but the serum contained no agglutinin or complement-fixation bodies. It seems highly probable that guinea-pigs develop a high grade of immunity by means of their tissue elements and only to a very slight degree by means of the circulating blood.

In addition to the above researches, certain experimental studies were carried on by Baehr in connection with the two authors just quoted. Most of these studies have a direct bearing on the etiology of the disease. Various strains of the typhus bacillus were used, some obtained from individuals suffering from epidemic, some from cases of endemic typhus, and one strain that had been kept going by Anderson. This last virus was obtained from a case of Brill's disease in the fall of 1911, and it had been kept alive since that time by repeated passages through monkeys and guinea-pigs. During this time the virus had apparently undergone no apparent change in its virulence. The blood from typhus fever patients was defibrinated, and with this a series of guinea-pigs was inoculated and from one third of these pigs the same bacillus was isolated from the blood as had been obtained from the blood of individuals with typhus fever. In the guinea-pigs that showed only a very

mild reaction, the organism could not usually be found, but in the severer reactions the blood of the animals showed the presence of the bacillus in nearly one-half of the cases. This relationship between the blood culture results and the severity of the disease was also observed in human typhus cases. In animals, the fever reached its highest point on the second or third day of the disease, that is, some time between twenty-four and seventy-two hours after the onset, and it was found that the blood taken during this period was most liable to yield positive results. The virus was easily kept alive by transferring it from one guinea-pig to another, and it was also possible to produce a reaction by using a bacilli that had been grown upon artificial media for more than three weeks. Most of the cultures lost their virulence before this time and after four weeks neither of the strains studied were virulent.

It was also seen that typhus blood is only infective for animals if it contains a sufficient number of bacilli and many of the negative experiments may easily be explained in the light of these facts. Inasmuch as many times the blood used was taken at a time when there were not many bacilli in the blood, and when working with cultures of the bacillus, the length of time elapsing between the inoculation of the media and a growth of the bacilli was so long that in many cases the results were negative. The comparison between some of the results obtained by these studies and the experiments of transferring the disease by lice is instructive. In previous number of PROGRESSIVE MEDICINE, I have commented upon the experiments made on this subject and it has been definitely proved that the lice can act as the intermediate host in the transference of virus from man to man and monkey to monkey. These animal experiments have been made by Nicolle and LeCompte and Conseil, Ricketts and Wilder, and Anderson and Goldberger. More recently, Sargent, Foley and Vialatte[1] have transferred the virus of the disease from man to man by the use of lice. The fact that the organism is a bacillus and that it occurs in the blood of typhus fever only in relatively small numbers, probably explains some of the obscure points of transmission by lice. The presence of so few bacilli in the blood seem to render it more or less difficult for the lice to become infected, and this is probably why it has been difficult to transfer the disease unless large numbers of lice are used. The lice apparently become infected from five to ten days after the first feeding, and after this was found to be the case, Nicolle thought that this was evidence that the virus was protozoan and that this amount of time was needed for its development in the body of the louse. With the virus being demonstrated as a bacillus, the only explanation is that originally suggested by Ricketts and Wilder, that during this period the bacilli are increasing either in virulence or in number. There may be some

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[1] Compt. rend. Acad. d. sc., 1914, p. 964.

'other factors in lice transmission with which we are not at the present time familiar, inasmuch as the disease seems to spread during the winter season with extraordinary rapidity, under conditions ordinarily met with when epidemics prevail.

THE PROPHYLAXIS OF TYPHUS FEVER. The prevention of this disease consists practically of preventing infected lice from biting the individual, and the body or clothes louse is more dangerous in regard to this disease than the head louse. Among the measures that have been suggested is that of Blaschko.[1] Realizing that many times individuals are exposed to infection with lice, he sought for some simple efficacious way of preventing this, and has found that the inunction of the body with a 5 per cent. naphthaline-vaseline ointment is most efficacious. As the use of such an ointment may be impossible, particularly with soldiers, he suggests that where it cannot be used, the use of powdered naphthaline, each soldier to be given from 30 to 50 grams, and, when lice are encountered, about one-half teaspoonful is shaken around the collar, from which point it gradually falls to the body. A pair of more or less closely meshed bags may also be filled with the powder and worn about the neck. Small quantities of it may also be used at night in the beds or under the clothing.

**Tuberculosis.** THE TUBERCULOSIS SITUATION. It is interesting to note what has been done in this country in ten years of active campaign against the disease. In 1905, when the National Association for the Study and Prevention of Tuberculosis began active operations, the forces in actual use to combat the great white plague consisted of 39 antituberculosis associations and committees, 115 sanatoria, hospitals and camps, having a capacity of only 9,000 beds, and 20 special tuberculosis clinics or dispensaries, treating less than 10,000 patients a year, and little or no home-nursing supervision. Many of these units were poorly equipped, and were relatively inefficient. There were at this time no open-air schools, no fresh-air classes, no special provision for tuberculous children. There were probably not more than 5000 people actually interested in the prevention of the disease, and not more than $5,000,000 approximately was spent in the United States in 1905 for caring for, and preventing, the disease. One of the first of the active steps of the campaign was a tuberculosis exhibit held in Baltimore under the auspices of the Medical and Chirurgical Faculty of Maryland. This was the pioneer of organized health exhibitions having in view the definite object of teaching the public what can be done in lowering the death-rate from any special disease. After ten years of continuous effort, a fight against tuberculosis has been organized in almost every State, and in a large number of cities and towns, and as far as it goes, the fighting force may be regarded as well standardized and highly

[1] Deutsche medizinische Wochenschrift, January 1, 1915.

efficient. There are at present some 1500 antituberculosis associations and committees, including nearly 35 State organizations. There are 600 sanatoria, hospitals, and day camps, with a combined bed capacity of over 35,000, while 450 tuberculosis dispensaries and clinics treat annually over 1000 cases, and working in conjunction with these are several thousand visiting nurses. There are 500 open-air schools and fresh-air classes, and special institutions for tuberculous and anemic children. The number of people actively interested in preventing the disease numbers over 100,000, and in 1914 over $200,000,000 was spent in the antituberculosis work in the United States.

It is natural to ask what has been accomplished by this campaign. The figures, while encouraging, do not state adequately what has been done. The death-rate in the registration area in the United States in 1905 was 166.7 per 100,000 of the population from tuberculosis of the lungs. The death-rate in the same area in the last available report, which was in 1913, showed a remarkable lowering to 127.7 per 100,000 population from tuberculosis of the lungs. This lowering of the death-rate is in itself quite remarkable, but it must be borne in mind that a large number of cases of tuberculosis are now diagnosed correctly early, and are treated, either becoming cured or arrested. Naturally, the well-to-do and educated will avail themselves of the privileges more than the more unfortunate classes. Ten or fifteen years ago tuberculosis of the lungs was common among the well-to-do. Today, while not entirely absent, it is lowered tremendously, and deaths from this disease among those with sufficient wealth to be properly cared for, are beginning to be almost exceptional. The ideal which the National Association has in mind, and which it hopes to realize in 1925, is the provision of adequate care for all consumptives, either at home or in institutions. One of the greatest needs of the present time is the care of the tuberculous negro. He is today one of the greatest factors in keeping up the death-rate and in spreading the disease, and with a few exceptions, little has been done to give adequate care to this race, unfortunate in its predisposition to the disease.

**Vaccination.** Last year I called attention to the work of Fornet, who found that etherized vaccine virus remains sterile and active for weeks. His experiments have been repeated by Paschen, by Gins, and by Groth. Roseo[1] has made some experiments with this method, and also with subjecting ordinary glycerinated vaccine virus to the action of the vapor of ordinary sulphuric ether, such as is used for anesthesia. He found that the virus so treated could be rendered completely sterile by this method, and that inoculations made with this virus produced positive and uniform results in the way of vaccine vesicles, and he believes there is less danger in causing secondary infections by using such

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[1] Il Policlinico, Sezione pratica, December 20, 1914, p. 1777.

virus. It is interesting to note, however, that he does not believe that this virus will keep as well as the ordinary glycerinated material, and in order to prove this, he subjected tubes of virus treated with ether, and others untreated, to a constant temperature of $-4°$ C. for two months. At the end of this time he found that the virus that had been etherized would not produce positive results on children, whereas that untreated gave the usual typical postules.

THE PURE CULTIVATION OF VACCINE VIRUS. The subject of producing a vaccine virus free from cantaminating bacteria has occupied the attention of many assiduous workers over a long period of time. The method almost universally used consists in transmitting the virus in the skin of one calf to that of another, and collecting the serum from the resulting vesicles under the most rigid precautions, in spite of which a certain number of bacteria find their way into the virus, chiefly from the surfaces of the skin and air. Various means have been taken to free the virus of these bacteria. That most generally employed being to add glycerin and then to keep the virus in a refrigerator from one to three months until the bacteria present have been reduced to a minimum. The spore-bearing bacteria are not affected by the action of the glycerin. The bacteria which remain in the virus are fortunately quite harmless to the human being and may practically be disregarded. The bacteria may be eliminated much more quickly by keeping the virus at a higher temperature or by the addition of 1 per cent. of phenol, either alone or in the glycerin, or by the addition of one part per thousand of oil of cloves to the glycerin. Another method recently suggested by Fornet consists of treating the virus with an excess of ether. By this method at the end of forty-eight hours a virus can be produced which is free from all bacteria except those bearing spores. All these methods, however, reduce the activity of the virus to a greater or less extent.

In addition to the calf, rabbits are sometimes used, the skin being shaved before making the inoculation. The vaccine virus shows a distinct tendency to localize in the pavement-epithelium, and when it is introduced directly into the floor or peritoneal cavity, it lodges in the epithelium of the skin and the mucous membranes, provided that they are injured within a few hours of the inoculation, while in a few hours more it disappears completely from the circulation or peritoneum and if it is not taken up in the epithelium is entirely lost. Various observers have noted the fact that characteristic lesions may be produced by inoculation of the testes of rabbits or calves and by various experiments made in recent years, the possibility of the rabbit as a favorable subject for the multiplication of parasitic organisms has been demonstrated. Noguchi[1] has been able to produce a vaccine virus free from bacteria by growing the virus in the testicle of the rabbit. In order to free the

[1] Journal of Experimental Medicine, June 1, 1915, p. 539.

virus from bacteria as far as possible, the method of Fornet was employed under the usual aseptic precautions. The virus is injected into the testicle, a more or less uniform distribution being obtained by turning the direction of the needle. The multiplication of the virus within the testicle reaches its maximum four or five days after the injection, and then remains stationary until the eighth day, when it begins to diminish, until at the end of five weeks it has practically disappeared. The testes are removed and ground with sterile salt solution, or 60 per cent. glycerin, and this is kept as a stock emulsion. Cultures are made in order to determine whether or not this material is free from bacteria. It is necessary to pass the virus through several rabbits in order to bring about an adaptation of it to the testes, as the strength during the first transfer may be less than the original specimen from which the strain was derived, subsequently the activity rises until it reaches its maximum point at which it equals that of the skin strain. The vaccinal processes in the skin, cornea, and testicle of the rabbit are practically identical, whether the virus employed for the inoculation has been the original stock strain or the pure testicular strain, and the lesions produced in the calf with the two strains are also identical, and the same may be said of the reactions produced in the human being.

The changes in the testicle of the rabbit have been studied, and it is found that during the first twenty-four hours there is little change except there is some exudate in the interstitial spaces. At the end of forty-eight hours there is a considerable swelling and induration; this increases rapidly and the testicle becomes edematous. The amount of virus present after the first twenty-four hours is almost *nil*, but after forty-eight hours it reaches about one hundred times that found at the end of the first day, and at the end of thirty-six hours the infiltration has increased and the vaccinal activity is at least three hundred times greater than that found in the first twenty-four hours. On the fourth day the testicle is more compact and less elastic and the color has become a purplish-red, and here and there are irregular yellowish areas of different sizes. At this time the activity of the virus has reached its maximum, and is about one thousand times as great as at the first twenty-four hours. After six days the testicle becomes softer, and the edema and filtration begin to grow less. From this time there is a rapid decrease in size, so that on the tenth day the organ is somewhat smaller than normal. Similar experiments were carried on with young bulls, and it was demonstrated that vaccine virus may be obtained from these animals as well as from rabbits. The immunity conferred by this virus was tested upon rabbits and found to give the same results as that obtained in the usual manner from calves. By using this method, Noguchi has transferred the virus some sixty times in rabbits, and this virus comes up to the methods originally advised for standardizing this product. Theobald Smith recommends the skin of the calf for

testing the virus, and requires that the eruptions produced there must correspond with that on the skin of a child. Other observers, as Calmette and Guèrin and Camus, employ the skin of the rabbit, while Chaumier first employs animals and then tries the effect on a few children before distributing the virus. Henseval and Convent consider that a preparation which produces, on the skin of the rabbit, almost confluent eruptions in a dilution of one to five hundred, can be considered a suitable vaccine. Such a sample always causes an uninterrupted eruption along the line of the skin of a child. The testicular vaccine from rabbits comply with all the above requirements and some of the samples even exceed them, as they produced confluent eruptions in dilutions of one to ten thousand. The production of vaccine virus in this manner for use by the general practitioner may probably be accomplished at a less cost than by using calves. It has the additional advantage that the animals do not have to be kept to see if they are free from the foot-and-mouth disease. This disease in some States has closed the market to calves, so that the production of vaccine virus has suffered considerably. This virus is at present being used by certain observers, and last summer I had the opportunity of seeing several children that had been vaccinated by this method, and the results were most satisfactory. The advantage of this form of virus is that it is absolutely free from contaminating bacteria, and particularly that it can be put on the market a week after it has been made, and so a higher degree of potency can be secured than by the methods formerly used in its production.

PROPHYLACTIC VACCINATION FOR VARICELLA. Kling, of Stockholm, has previously experimented with this disease. He used the material from the vaccine vesicles, transferring it by means of multiple punctures made on the arm of the person to be vaccinated. Rabinoff[1] has made some experiments along the same line, using the serum obtained from the chicken-pox vesicles and transferring it into small scarifications. The chief difficulty seems to be to obtain the virus, inasmuch as animal vaccinations have been unsuccessful. Early in the course of the disease, while the vesicles are still clear, some material can be procured in small capillary tubes which allows the virus to be transported. The amounts of the virus that can be secured ordinarily is so small that the material was transferred directly. Care must be taken to avoid the transfer of any other transmissable disease in the donor. Some idea of the highly contagious character of the disease in the institution in which the observations were made can be obtained from the fact that of 38 susceptible children there were 21 cases. Among another group of 142 susceptible children, 114, or 75 per cent., developed the disease. Of these 6 cases developed the disease; 2 on the day following vaccination, 2 seven days later, 1 nine days later and 1 ten days later. In other

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[1] Pediatrics, July 15, 1915, p. 339.

words, all the cases among the vaccinated children developed within the inoculation period of the disease, which was about sixteen days.

**Verruga Peruviana.** THE VIRUS OF VERRUGA PERUVIANA. Strong and Tyzzer[1] have contributed an article on this subject in their fourth report to the Harvard Commission. In their previous publications they refer to the fact that they had been unable to transmit the parasite of oroya fever (see same) to animals, and that intravenous inoculations of blood containing the parasites Bartonella bacilliformis into monkeys and rabbits, and intratesticular ones into rabbits, produced neither local lesions, verrugas on the skin, nor lesions elsewhere. In contradistinction to this the inoculations with the virus of verruga gave positive results in these animals, with the production of definite lesions which, in the case of monkeys, when the inoculations were made into the skin, resembled those observed in human cases of disease.

The experiments were carried on with the view of determining four things: Whether the disease was directly inoculable; if a visible microorganism was present in the lesions, if a spirochete was present; and to differentiate the disease from frambesia and syphilis. Monkeys were found to be best for experimental purposes. If the skin over the eye is scarified and inoculated with small portions of a verruga nodule, the disease will usually develop after an incubation period of from ten to twenty days. The first appearance is that of a small papule, which gradually enlarges, and later presents a typical picture of the verruga nodules as seen in human beings, and with a similar histological structure. The virus has been transmitted from animal to animal through twelve successive series of monkeys since Strong and Tyzzer left South America over a year before their report was published. They produced typical lesions in this manner in twenty-five monkeys. When the monkeys are inoculated with the virus either directly from man or from another monkey, a localized lesion occurs, but no generalized eruption. When monkeys are inoculated with smallpox virus, a modified form of the eruption is produced, so that this animal is apparently not as susceptible to the virus of verruga or of smallpox as is man. The verruga inoculation does not cause any appreciable febrile reaction in the monkeys, and none of them died from the disease. In the monkey the lesions gradually disappear after four or five weeks from the time of the inoculation. The virus may also be sometimes transmitted to rabbits and to dogs. In these animals the intratesticular inoculation produces a more or less characteristic lesion after an incubation period varying from ten to twenty-two days. The appearance of the lesion is not that of one resulting from an acute inflammatory process, but rather from a low grade of inflammation. By repeating the inoculations, the virus gradually becomes attenuated, and finally fails to produce any lesions. Rabbits are probably not very susceptible, and only a certain percentage

[1] Journal of American Medical Association, April 3, 1915, p. 1124.

of the inoculations are followed by the development of a definite lesion.

The earlier literature on the subject of this disease, and also of oroya fever, states that the lower animals were susceptible, and that infection had been observed in dogs, cats, mules, and poultry. If the results of the earlier observations and experiments are subjected to critical examination, it will be found that there has been no demonstration that the virus of verruga could be transmitted to animals until experiments have been made on monkeys.

Jadassohn and Seiffert[1] and Mayer, Rocha-Lima, and Werner[2] were both able to transmit the disease to monkeys through several generations. The material from the first case was studied by Cole,[3] and he showed that the histological structure of the nodules produced in the monkeys was similar to that observed in human beings. His experiments have also been done by Ribeyro, in Lima, according to Strong and Tyzzer. These observers did not find any cases of natural infection in dogs, cats, donkeys, or poultry, and they do not believe that the disease occurs naturally in these animals. It seems that the virus is only transmissible in certain stages of the disease even in man, and unless it is obtained from the human case during that stage, it is either innocuous for animals, or its virulence is greatly reduced. There are numerous experiments that have been made in regard to the cultivation of the virus of verruga, and the results of these being negative, inasmuch as no definite microörganism could be demonstrated, either by microscopic examination or by subculture, and no lesion could be produced by the inoculation of these cultures, Strong and Tyzzer found that most of their experiments were failures. They report, however, their results in a series of cultures made in ascitic fluid containing rabbit's testicle, to which had been added exudates produced by injections of aleuronat containing leukocytes and small fragments of verruga nodules. In several instances such cultures showed certain differences from the control ones, notably in the cloudiness of the media, and in the formation of a fine granular precipitate along the sides and bottom of the tube. These cultures, however, revealed no bacteria or other visible microörganism, and subcultures on agar gave no apparent growth. In the case of one monkey inoculated with such a culture, which had been incubated for sixteen days at 37° C., a small group of reddish papules appeared after an incubation period of twenty-one days. These never developed into extensive lesions, as almost invariably happens when fresh virus is used, and they disappeared in a short time.

Experiments were also performed to demonstrate the filterable qualities of the virus, and rabbits inoculated with the diluted filtrates

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[1] Zeitschrift f. Hygiene und Infectionskrankheiten, 1910, lxvi, 247.
[2] Münchener medizinische Wochenschrift, 1913, No. 14.
[3] Journal of Cutaneous Diseases, 1913, xxxi, 384.

of suspensions made by grinding the human lesions in salt solution developed no lesions. These experiments were not conclusive, as they were not done on monkeys, a more susceptible animal, and this was not done owing to the scarcity of the monkeys at hand. Subsequently, some experiments were carried out, using portions of the nodules from monkeys, but these filtrates failed to produce lesions in experimental monkeys, and these animals were not rendered immune to subsequent infection by the unfiltered virus.

Most careful investigation of tissues made in various ways has not revealed any visible microörganism, and the authors believe that in spite of their lack of success, the virus of verruga will ultimately be shown to be a filterable one. It has been generally regarded that verruga bore certain resemblances to smallpox, but careful consideration of the two shows that there is practically little ground for this assumption.

**Whooping-cough.** COMPLEMENT-FIXATION IN WHOOPING-COUGH. Last year I commented on some work that had been done in whooping-cough, particularly in diagnosis by means of the complement-fixation test. One of the most important contributions during the past year is by Olmstead and Lutinger.[1] This article is the more important to me as it contains a number of useful references to the work which has already been done. The antigen which is used seems to be a matter of primary importance. Bordet and Gengou used a saline emulsion of the pertussis bacilli grown on a solid medium. Meier found that the serum of whooping-cough patients reacts with an extract of the long tissue of patients dying from it. Numerous observers have repeated the experiments with the Bordet-Gengou bacillus with varying results. Differences may probably be explained by variations in technic, such as the method of preparing the antigen, the amount of it used in the dose, the amount of serum used, the time and temperature allowed for fixation and the interval between adding the sensitized cells and the reading of the results and similar things. The only discrepancies in the previous investigations are the statements made by Manicatide, who claims to have discovered in what he calls a Bacillus Z an etiological factor in pertussis, and he found the serum of 19 whooping-cough cases to give a positive complement-fixation reaction with an antigen of Bacillus Z. Negative reactions were given by six normal serums. Olmstead and Lutinger have used for antigens various strains of what they regard as typical Bordet-Gengou bacilli taken from the sputum of cases in which the diagnosis was whooping-cough and they have also used atypical Bordet-Gengou bacilli derived from supposed whooping-cough cases and various strains of typical influenza bacilli. Altogether they used twenty-three different antigens. They believe that the best antigen is made by autolyzing an aqueous emulsion of a twenty-four to forty-eight-hour growth of the Bordet-Gengou bacillus of eighteen to twenty-

[1] Archives of Internal Medicine, July, 1915, p. 67.

four hours at 56° C. and shaking for several hours. The closeness of relationship of various strains is still under investigation. In order to obtain the maximum number of positive reactions it may be necessary to use a polyvalent antigen. An active serum may give a non-specific positive reaction, and a negative reaction given by an active serum is stronger evidence of the lack of an infection, that is, a negative reaction given by inactive serum. The tests were made on 1100 cases or suspected cases.

The earliest case tested had been whooping five days. The cases tested were divided into three groups: those from unvaccinated cases of whooping-cough, those from vaccinated cases, and those from prophylactic cases, that is, cases that received vaccine before or after exposure to whooping-cough and did not develop a whoop. Forty-eight cases of unvaccinated whooping-cough were tested, some in the whooping stage and some in convalescence. Twelve of the whooping cases gave a positive reaction with at least one Bordet-Gengou antigen and 3 of the convalescents gave a positive reaction. The percentage was 37.5 and 12.5 respectively. The total number of vaccinated cases tested was 32, 50 per cent. of the cases that were whooping reacted, and 57.7 per cent. of the convalescent cases gave positive reactions. Sixty-seven serums from normal or individuals suffering from other diseases were tested and there were no positive reactions with either the Bordet-Gengou bacilli or the atypical bacilli. The administration of the vaccine seems to have an effect on the complement-fixation reaction, but it seems doubtful if the complement-fixation factors were developed in the serum as the result of the vaccine alone. Among 12 vaccinated children who did not develop whooping-cough, only 1, or a percentage of 8.3, gave a positive reaction, and this child had coughed for two weeks and was probably a case running a typical course. Two adults who had been inoculated with large amounts of the vaccine at no time gave a complement-fixation test when inactive serum was used. Active serums are of little use, as the results obtained by them are apt to lead to inaccurate conclusions. All observations should be made with inactive serums. With the improvement of the technic they found their results were better, and the number of positive reactions given by the serum of pertussis cases increased, but even among the pertussis patients the number of reactions is still far below 100 per cent. Still, in spite of the difficulties encountered there is specific evidence to be strongly in favor of the etiological relationship of the Bordet-Gengou bacillus to whooping-cough. Take it all in all, about 40 per cent. of the whooping-cough cases have given a positive result when inactive serum was used. A ++, +++ or ++++ reaction with an inactive serum with an antigen of the Bordet-Gengou they regard as diagnostic of whooping-cough, whereas a + or ± reaction is suspicious. A negative reaction has little or no significance.

# DISEASES OF CHILDREN.

## By FLOYD M. CRANDALL, M.D.

LAST year I had occasion to say that pediatric writers had covered their particular field more evenly than had been the case for several years. The same may be said this year. For several years previous some particular subject would apparently be of special interest and an excessive number of articles would appear upon it. This year, as last, no particular subject has received an abnormal amount of attention. The unusual feature has been the small amount of pediatric material available from foreign sources. This is, of course, explained by the war conditions. Pediatrics no doubt has suffered as much, or more, than any other subject. In the foreign journals that have been received, surgical subjects have been predominant. Certain phases of medical practice and hygiene have also received much attention. Owing to these conditions, the material for the present article has been drawn from American sources more largely than it has ever been before.

**Fever in Children.** Every practitioner knows that elevations in temperature are more common in children than in adults. The exciting causes are often very obscure, but the predisposing cause, as shown by the instability of the nervous and heat centres, must always be borne in mind. In an article upon the obscure fevers of infancy and childhood, Ratchford[1] refers to the fact that the age of the child has a most important bearing. In the absence of an evident cause of illness, fever during the first week of life may be assumed to be of the inanition type, and should be treated by the administration of water or breast milk in quantities sufficient to produce elimination of the toxic substances responsible. Severe, prostrating fever beginning in the second week of life may, in the absence of marked intestinal disturbance or other evident cause, be considered due to sepsis. In children over one month or under two years of age, intestinal toxemia is the commonest cause of fever. If the temperature falls and remains low under catharsis and starvation for twenty-four hours, the diagnosis is confirmed. If fever continues for three or four days, otitis media should be thought of, even in the absence of aural or mastoid symptoms. A sustained high temperature of 103° or 104° F. in infants should always be treated as a lobar pneumonia until a definite diagnosis can be made. In a child over three years of age free from signs of pneumonia, continuous fever should

[1] Lancet-Clinic, October 2, 1915.

lead to a tentative diagnosis of typhoid. The fever of tuberculosis is always characterized by the slight degree of accompanying discomfort. A remitting fever, persisting day after day without apparent cause, should always arouse a suspicion of pyelitis and lead to an examination of the urine.

In considering the so-called inanition fever of the newborn, Mayer[1] refers to the frequent abruptly downward trend of the weight and rise of the temperature during the first three or four days after birth. The prognosis is favorable and the disturbance does not have much importance. Cool packs to reduce the temperature and possibly change of food rapidly correct the condition, as a rule.

**Blood Coagulation in Infancy.** But few studies have been made upon this subject. The most important in this country are those of Carpenter and Giddings who called attention to many factors and sources of error which have brought about a wide variance of results. Extended studies are now reported by Shaw and Williams,[2] of Albany. Their first series of cases was that of 108 healthy infants under two years of age by the Dale-Laidlaw method. By this method the range was between one minute fifteen seconds, and one minute forty-eight seconds, and the average coagulation time was one minute thirty seconds, which is a slightly shorter time than in adults.

With another series of cases investigated by the Russell-Brodie method, the results were as follows:

|  | Range. | Average. |
|---|---|---|
| 95 examinations in infants under one year of age | 3′ 20″ to 4′ 42″ | 3′ 47″ |
| 35 examinations in infants between one and two years of age | 3′ 20″ to 4′ 45″ | 3′ 54″ |
| 20 examinations in infants between two and three years of age | 3′ 24″ to 4′ 45″ | 3′ 58″ |

Sladen and Emerson found the average coagulation time in healthy adults to be five minutes five seconds. The results obtained by Shaw and Williams by both methods were remarkably consistent, and they believe they have established a normal coagulation time for children.

**Blood-pressure in Children.** Studies upon the blood-pressure in children are reported by Melvin and Murray.[3] The cases studied were forty in number, whose ages ranged between four and fourteen years, with an average age of nine and one-half years. They employed the auscultation method, believing it to give the best results. The armlet used was narrower than that commonly used in adults, being 8 cm. broad. The average systolic pressure was found to be 108.1 mm. Hg., the diastolic

[1] Medizin. Klinik, August 22, 1915.
[2] New York State Medical Journal, September, 1915.
[3] British Medical Journal, April 17, 1915.

72.4 mm. Hg., and the pulse pressure 35.7 mm. Hg. The striking feature is the fact that the systolic pressure in children is only slightly lower than that in healthy adults. On the other hand, the diastolic pressure averages higher in children than in adults, and the pulse pressure is necessarily lower. The relation of the pulse pressure to the systolic pressure in children was 1 to 3; while it was 1 to 2.7 in adults. The relation of pulse pressure to diastolic pressure was 1 to 2 in children and 1 to 1.6 in adults.

**Fragilitas Ossium with Blue Sclerotics.** Blue-tinged sclerotics are not infrequently seen in infants and young children. In tuberculosis such a blue tinge may be noticed. Congenital heart disease with marked cyanosis may be associated with blue sclerotics, and is largely due to venous congestion. In negro infants and children, patches of pigmentation in the sclerotics are sometimes seen. Blue sclerotics, however, may be seen entirely distinct from any of these. The condition is congenital and the sclerotics are of a uniform blue color. The first to note the peculiarity was von Ammon. The association of brittle bones with blue sclerotics has been recognized for several years. A case is reported by Herrman,[1] of New York, who also presents a review of the literature. The patients affected with this condition are usually small and delicate, frequently fair-haired. The large size of the head is mentioned in several cases. The color of the sclerotic varies in different individuals from a pale azure or porcelain blue to a leaden hue. The color is uniform throughout and involves the entire sclerotic from the cornea as far as the eyeball is visible. According to Rolleston, the color is more distinct on some days. Usually there is no accentuation in the ciliary zone, but Herrman mentions one case in which the color was deeper in the ciliary region and masked toward the equator on account of the increased thickness of the overlying conjunctiva, and also masked in those regions in which the muscle tendons overlie the globe. As was pointed out by Buchanan and others, the fibrous tissue is abnormally thin; the individual fibers are of normal thickness but are deficient in number. The cornea is thin and the anterior elastic lamina is absent, which is said to account for the astigmatism frequently present in these cases. The choroid is also abnormally thin, which causes Fuchs's coloboma and the oval appearance of the optic disks.

As to the bones, there seems to be a defect in the quality and quantity of fibrous tissue forming the framework which causes a lack of elasticity and the tendency to fracture. This change is well shown in radiographs, and, as has been pointed out, not only the bones, but also the soft parts are affected, so that sprains are not infrequent.

The change in the eye is so apparent that it would naturally be the first part noticed. According to Ostheimer, of 32 patients

[1] American Journal of Diseases of Children, March, 1915.

with "fragilitas ossium" who were able to go about, only 6 were noted to have blue sclerotics. Not all patients who have blue sclerotics have brittle bones, but in the families in which blue sclerotics was an inherited peculiarity, all those members who had brittle bones had blue sclerotics also. The blue sclerotics, like the brittle bones, may, however, occur independently of hereditary transmission. Ostheimer states that in only 8 of 117 cases of "fragilitas ossium" was the condition known to exist in either parent, and in 24 was it present in brothers and sisters.

**Chorea.** A study of the *etiology* of chorea is presented by Strauss,[1] of New York. Upon the relation of rheumatism to chorea, he holds that, in view of the varied opinions expressed, no positive statements can be made until the etiology of both conditions has been determined. There is evidence of the streptococcus in most cases of polyarthritis. Diplococci and the Staphylococcus pyogenes aureus have been found in choreics, and much biological work has been done by the different methods, although the results differ widely. Chorea has been known to follow typhoid fever, malnutrition, syphilis, and abuse of alcohol, etc. It is a disease of early life and occurs most frequently between the ages of six and fifteen. It is more apt to occur in wet, cold seasons. It is frequently febrile in the early stages, and often gives evidence of endocarditis. The fatal cases show the rugæ of endocarditis. What influence the cortex exerts is unknown. In fatal cases the brain lesions are those of acute encephalitis, and this brings up the question to what extent such lesions are present in ordinary cases that go on to recovery. The probability is that this will never be known until some case of moderate chorea dies suddenly and an autopsy is obtained. In the present state of our knowledge, the only conclusion that is justifiable is that chorea is probably of infectious origin. But the data at present is altogether insufficient to decide the nature of the infection.

**Rumination in Infancy.** The literature of this strange condition is very scanty. A marked case is reported in great detail by Strauch,[2] of Chicago. The child was first seen at three months, when a diagnosis of rumination and pylorospasm was made, the latter by the use of the $x$-rays and bismuth feeding. The diagnosis of rumination offers no difficulty, as the distinction from other allied affections is to be made at first sight, since ructus, vomiting, and simple regurgitation are very different. The characteristic of ruminating is repeated chewing and swallowing of the food habitually regurgitated without effort or nausea, perhaps with a sensation of satisfaction. No real chewing movements were to be observed in Strauch's case, but movements rather resembling bottle suckling. This seems to him quite natural, since at this age suckling movements are found as the physiological reflex automatism,

[1] Archives of Pediatrics, February, 1915.
[2] Journal of American Medical Association, August 21, 1915.

while chewing, strictly speaking, is only acquired later when solid or half-solid food is ingested.

No case of congenital rumination is on record. In the cases reported, it has been acquired in the course of some gastro-intestinal disturbance; but a neurotic constitution often is said to have played an important role at the same time. The beginning of rumination in the 6 patients tabulated by Bruening was between the third and seventh month of life. Peiser observed one beginning at the age of four weeks. In Aschenheim's case the five-months-old baby began to vomit during ablactation dyspepsia in the sixth week of life with symptoms of pyloro-spasm, and two weeks later it ruminated. In the second case vomiting began at the age of seven months in connection with a parental infection likewise with symptoms of pylorospasm. Rumination began two weeks later.

A great variety of therapeutic measures, especially of a dietary nature, have been tried, but with uncertain success. Meyerhofer and Huldschinsky saw quick results from gruel feeding; others, as Lust, saw no therapeutic result therefrom, apart from the fact that rumination may occur so early that continuous gruel feeding is impossible. Pouilot claimed a cure in his case from the administration of the gastric juice from the hog. Maas saw improvement from breast and buttermilk feeding, with strict avoidance of excitement or irritation of the baby. In other instances a spontaneous cure took place, or rumination con-tinued. Lavage, gavage, medication with hydrochloric acid, atropin, cocain, alkalies, and bromides used against the hypersensitiveness of the stomach have proved disappointing. The prime purpose should be the cure by diet of the disturbance underlying the pathogenic process, such as the dyspepsia, gastrospasm, or pylorospasm and habitual vomiting, which account to a great extent for the great inanition and atrophy of ruminating infants.

In the case reported, the loss of food by overspilling, the dyspepsia, enteric catarrh, and atrophy gave the main indication for the therapy. Overspilling was reduced through the use of sand-bags to the sides of the head, to prevent the child from turning its head to the side. Albumin milk and hydrochloric acid improved the dyspepsia. Prevention of nose-breathing for two hours after every feeding, by the insertion of cotton into each nostril, was regularly effected. This forced the baby to stop ruminating and in the course of about two weeks had also strikingly lessened regurgitation. The result of this procedure was so marked that it is to be recommended in similar cases.

**Open-air Schools.** The open-air school movement is spreading rapidly over the country. There is a deep interest in the physical welfare of school-children, and it is the conviction of part of our people that the time to serve these children is when they are in the public schools; that it is not good business to allow them to sit for six or eight years

with handicaps and defects which are preventing them from receiving the thing which the school wants to give.

A very informing article on this subject is that of Kingsley,[1] of Chicago, who has had large experience with their workings. He reports that New York City has 250 open-window classes with the same number of children in each class as in the regular schools, and the promoters say that the results are better than in closed rooms. New York also has twenty-five classes for anemic children, and in these classes there are twenty-five children each, and here again the results are better than when these children go to the usual closed room. There is no feeding or rest period in these classes. Many other cities have open-window classes. In California, and in many other localities, the movement is spreading rapidly. But something more than opening the windows is necessary if these children are to be restored to efficiency and made useful citizens. In many places the penny lunch or diets of milk and crackers, sandwiches, or other less expensive methods of feeding are in vogue. This work should have careful medical direction and supervision. Children should not be subjected to extremes of temperatures unless they are properly provided for it. There is no reason, however, why all the schools in the country should not approach much more nearly the open-air schools than at present.

**Cubic Air Space for Institutional Infants.** An extended investigation upon this important subject is reported by Southworth,[2] of New York. It was undertaken in an attempt to reach some definite conclusions in view of the fact that the regulations in most States are extremely variable. In New York, for example, the regulation is 600 cubic feet for children under twelve years of age and 800 cubic feet for persons more than twelve years of age.

Allowing for some divergence of opinion, the following conclusions seem to be justified: The majority of hospitals and institutional wards for infants provide 1000 cubic feet of air space for each inmate. Even with 1000 or more cubic feet of air space, free ventilation is deemed very important. No allowance of cubic air space is at present made for the necessary attendants in wards. Reduced cubic air space means less square feet of floor space and less separation between cribs, with proportionately increased opportunity for the spread of cross-infections. There is a growing belief that even with free ventilation, separation of the beds plays as important a role as increased air space. On account of their handicaps, bottle-fed infants require more space than nursing infants. Bottle-fed infants require as much cubic space as so-called "medical" or "surgical" cases among infants. The majority of pediatric physicians believe that infants should have as much cubic air space as adults, if not more, and this is especially true of bottle-fed

[1] Journal of American Medical Association, October 30, 1915.
[2] Archives of Pediatrics, September, 1915.

infants, because they are more susceptible to infection, suffer in their nutrition in their confinement, and notoriously do badly in all save the best-equipped institutions.

Bottle-fed infants, when retained for any considerable length of time in hospitals or institutions, cannot properly be classed as well infants, because a considerable portion of them suffer both in their digestion and nutrition, as well as from acute intercurrent affections, and therefore require unusual attention in their feeding and general nursing care. Limited cubic air space involving limited floor space is an important contributary factor, though by no means the only factor, in the high mortality of artificially fed infants. Even with a liberal allowance of cubic air space, free and abundant ventilation is of equal importance In addition, provision for roof gardens, porches, and sun parlors is advisable, if not imperative.

The mere presence of windows does not of itself constitute ventilation, but their proper use must be provided for. A low minimum of cubic space established by law without definition of what constitutes efficient ventilation, and without enforcement, may be more harmful than beneficial, and constitute a virtual license to overcrowd in ill-ventilated wards. The example of the more progressive hospitals and institutions, which provide the larger amount of air space per infant, together with free ventilation, is to a considerable extent nullified by State and local regulation, licensing for the less progressive the employment of minimum air space for a class of infants among whom there is admittedly a high mortality.

**The Diseases of Children as Influenced by Heredity.** The fact that the diseases of childhood are influenced by periods of development is the keynote of a paper by Crandall.[1] These periods are largely influenced by hereditary tendency. The development period is a most important one in the life of an individual. It would be true even if the baby were simply a miniature man and expanded uniformly to reach adult size. This is far from the fact. A few organs, like the kidney, are small in size but perfect in development and functionate perfectly at birth. The brain is the most marked exception to this rule. The proportion of brain weight to body weight at birth is 1 to 8, in adult life, 1 to 43. That is, the baby's brain is five times larger than the adult's as compared to the body weight. It increases about 400 per cent. during the first seven years. In contradistinction to this is the important fact that the functional development of the cerebrum is almost nothing, while the cerebellum is excessive in size and the functions of animal life are fully developed.

At least twenty-five years are necessary for the attainment of full physical and mental development. While this slow development is

[1] Journal of Medical Society of New Jersey, February, 1915.

true of the physical man, it is doubly true of the mental man. There is a peculiar asymmetry between his mental and physical development. At one year the infant possesses excessive brain substance but its capacity is not one-hundredth part of what it will be after twenty years of education and experience. At ten years the brain has attained almost its full size and it is not at all uncommon to see a boy of that age able to wear his father's hat. But years of education must follow before he can be intrusted with his father's business or professional affairs. And that power will not come by itself. It is not inborn. It must be developed. The brain has certain well-defined periods and stages of development. It is easy to understand, therefore, why so many different nervous diseases develop at different periods and why so many defects appear for the first time at intervals during the first twenty-five years of life. The relationship of many of these diseased conditions to the period of development is clear.

The first of these periods is embryonic. Inability of the embryo to complete all of the formative processes of the various organs must result in defects more or less radical. If the defects are not excessive the child is born, but with more or less mental and physical deformity. Among these conditions are hare-lip, cleft palate, spina bifida, talipes in its various forms, acephaly, and various types of congenital idiocy. While not clearly defined and merged into each other, the periods are, nevertheless, fairly distinctive. The first covers the first seven or eight years of life. This is the period of special sense education, motor coördination, and speech. Two factors are important: functional development of the brain in its higher centres by education and motor coördination. At birth the child has virtually no coördinating powers. The hands and extremities move in an aimless manner. Even the eyes do not coördinate. The power of perfect coördination is very slow of attainment and is not fully reached until adult life. Its development, however, during the first seven years is rapid.

The pathological conditions incident to this stage of brain growth and muscular coördination are numerous. Among them are convulsions, night terrors, stammering, strabismus, hydrocephalus, and numerous minor conditions dependent upon the uncontrolled muscular and nervous activity.

The first year or year and a half are of great importance to all children. In some families it is particularly so, for the struggle to maintain independent existence is especially great. The babies are delicate and puny and the feeding problem is a difficult one. Get them through this period and the conditions all change for the better. Many a delicate baby develops into a strong and healthy child. In some families one may rely upon this characteristic and give a less gloomy prognosis than would otherwise be necessary.

The next period extends from seven or eight to thirteen or fourteen

years, when muscular motion becomes more thoroughly coördinated with emotion and the mental states. This is in a measure an extension of the preceding period and the pathological conditions are due largely to a lack of coördination. The diseases incident to this period are, therefore, chorea, epilepsy, somnambulism, migraine, and certain eye defects. During this period idiopathic epilepsy is prone to appear. Migraine may begin, the first symptom being recurring headaches.

The last period of development extends from thirteen or fourteen to twenty-five, and is marked by the perfection of the reproductive organs with many trophic, motor, emotional, and moral developments. We have now hysteria, epilepsy, eccentricity, and many forms of emotional wilfulness and moral perversions, sometimes attaining the gravity of dementia precox. In some families the tuberculous tendency shows itself at this period, and particular caution must be exercised. This tuberculous tendency which is such a grave menace to certain families, often seems to have expended itself by twenty-five or thirty. If the individual with such a heredity can safely be carried past that period, the tendency becomes very slight.

At twenty-five we have virtually reached the end of the developmental period. The individual then settles to a fixed course which may continue for twenty or even thirty years with comparatively little change. During this time the first development of hereditary tendencies are at the minimum with the possible exception of the menopause, when inherited or family tendencies are apt to show themselves. This period having passed, we reach the period of later life and old age and are apt to again find evidence of inherited tendencies, such as arterial degeneration, chronic nephritis, diseases of the liver, or cataract. This period, however, is not within the scope of this article.

In studying heredity, we should not forget that there are elements of good heredity as well as bad, and they are just as strong—otherwise the race would have been destroyed long ago. The bad elements, such as tendency to disease or mental disorder, are so tangible that we sometimes come to feel that heredity only means the inheritance of bad tendencies. The bad tendency inherited from one parent is often neutralized by the good tendency of the other, and conditions we might expect do not appear. It is rare, however, that the offspring shows an even balance of inheritance from both parents. As a rule the child inherits largely from one parent, with frequently very little modification from the other. Thus we frequently see radically different types among brothers and sisters, each with the tendencies peculiar to that type.

Heredity is a potent predisposing cause in nearly all the neuroses common to the period of development. In some instances it is the only cause, neurotic conditions being invariable as they follow each other. In other cases heredity is only a predisposing cause, some active exciting cause being necessary to waken a disease into activity. Possibilities

of prevention are many, and the physician, especially one who knows the preceding generations, may forestall certain conditions in his little patients. In spite of all that may be done, however, many must suffer. Their fate was sealed before birth and no skill can overcome the defects they have inherited. Nevertheless, something can be done for all and some can be saved entirely.

**Rickets.** For many years attempts have been made to draw conclusions as to the etiology of rickets from experimentation. Leonard Findlay,[1] in a study of the etiology of rickets, asserts that spontaneous and experimental rickets in animals are not identical. The experiments show a deficiency in calcium and in the active stages of the disease the calcium metabolism of the body is perverted. There is principally an increased output of calcium in the urine and feces, which may actually exceed the calcium intake. Among the hypotheses to account for this perversion the two most commonly accepted are: A deficiency of calcium in the diet; disturbance of the metabolism, probably in the nature of the lack of a specific hormone, which prevents the utilization of the calcium. The first theory is controverted by the fact that the diet of the average rachitic infant is not deficient in calcium, as shown both by the author's observations and those of others. On the other hand, the author was able to produce the disease in animals by confinement without sufficient exercise, although they were given an abundance of available calcium. Further, the administration of calcium does not check the disease in man. There has been no evidence that deficiency of any article of diet has been in any way directly related to the development of either experimental or spontaneous rickets.

On the belief that confinement with insufficient fresh air, coupled particularly with lack of exercise, was an important causative factor, the author made extensive parallel studies of the living conditions of a large number of families in which there was no rickets and an equal number in which rickets was present, including only the active cases of the disease. The duration of breast feeding was found to have no influence upon the occurrence of the disease, and the same was true of the occurrence of the intestinal disorders. It was found that the earlier children in a family were attacked much more frequently than later ones. The probable explanation of this is the fact that the later children get much more outdoor air and exercise through being cared for largely by the older children rather than by the mother, who is much confined to the house.

A study of the available air space in the house allowed for the child showed that the smaller the allowance, the greater the frequency of rickets. Children who were not taken out of the house much showed a greater frequency of rickets than those who were taken out frequently.

[1] Lancet, May 8, 1915.

These studies therefore seem to confirm the belief that lack of fresh air and exercise is the most important etiological factor in the production of rickets. This is substantiated by the fact that in those families in which the disease is practically unknown, the children lead outdoor lives the greater part of the time, and in those communities from which the disease is absent, both in man and domestic animals, the mode of life is mainly an outdoor one.

In a study of the early manifestations and treatment of rickets, Rost,[1] of New York, refers to the fact that the underlying cause is not known. Still, who has a large experience, believes it is the result of fat starvation, brought about by insufficient food supply or lack of assimilation and the excessive use of carbohydrates. Winters is of the opinion that protein causes gastric disturbances, and that, as a result, the fats in the food are not properly metabolized; this and fat starvation are the factors. Holt states that the essential cause of rickets is dietetic, although hygienic influences play a very important role; the diet is usually very deficient in fat and often in protein, while it contains an excess of carbohydrate. When both fat and protein are low, rickets is more liable to occur than when fat alone is deficient. Monti and Zander have shown that an increase in lactic acid and a diminution in the hydrochloric acid in the stomach result in intestinal disturbances; These disturbances cause the elimination of certain salts from the food, hence the blood fails to receive what is necessary for normal bone structure. Several investigators have proved from animal experimentation that disturbances in the internal secretions cause rickets. Thus, Klose, Matti, and Vogt have shown that the extirpation of the thymus gland in dogs brought about changes in the skeleton of the animals similar to those observed in rachitic children.

As to the treatment, which has been so much discussed and has brought forth such a variety of opinions, Rost accentuates one important point, and that is, that all mothers during pregnancy and the lying-in period should be allowed a generous diet, such as meat, vegetables, cereals, milk, fruits, etc., except when contra-indicated by disease. In this way may we hope to bring about maternal nursing more readily and perhaps a good quality of milk, which might possibly help to diminish the number of cases of rickets in nurslings. The physician should insist upon the mother nursing her offspring if it is thriving; if not, regulate the mother's hygiene and try again. Perhaps a change in her habits or her diet may bring about a beneficial result. When a mother cannot nurse and artificial feeding must be resorted to, the cleanest raw milk obtainable should be given. Simple, uncomplicated formulas should be employed and a very close watch kept for the earliest manifestation of rickets. Only by these means can we prevent severe forms of the disease.

[1] New York Medical Journal, September 4, 1915.

When confronted with a case showing the earliest symptoms, a slight change or regulation in diet and the addition of orange-, prune-, or pineapple-juice may bring about a happy result. Sometimes small doses of phosphorus are beneficial, preferably the 1 per cent. solution in oil, because it is best tolerated in this form. Some physicians state that it acts almost as a specific. The early administration of animal broths or juices is very satisfactory oftentimes, particularly beef-juice. This is prepared by broiling a piece of thick steak (about one-half pound) for three to five minutes and expressing the juice with a lemon-squeezer. Begin with half a teaspoonful daily, plain or in barley- or oatmeal-water, and gradually increase the amount up to one or two ounces daily. It has been observed that certain cases of marked craniotabes in infants five months and older do exceptionally well under this treatment.

In older children, vegetable and lamb broths, as well as fresh vegetable purées, are beneficial; eggs, scraped beef, and cereals should be given; in the thin, poorly nourished type, malt extract may be given added to the milk. Thyroid extract, cautiously given, has been found beneficial in rachitic dwarfism and the obese. Koplik recommends that thyroid extract be given in combination with the saccharated ferrous carbonate in extreme anemia with enlarged spleen. Stoeltzner thinks that adrenalin has acted as a specific in some of his cases. Organotherapy, however, is still in the experimental stage, and we should await confirmation. Salt baths for stout infants are useful; massage at regular intervals should be given. During the acute stage of the disease, when the bones are soft, keep the children off their feet; when deformities occur, the cases belong to the orthopedic surgeon.

**The Pneumonias of Children.** Pneumonia occurring during the first two years of life is almost without exception bronchial in type. Pisek,[1] of New York, reports an exhaustive study of 1000 cases of pneumonia in children made in the wards of the Post-Graduate Hospital. A mortality of 43.3 per cent. was established. This is probably higher than would be obtained in private practice among well-to-do people, but is the average for the mass of hospital children of the cities. Lobar pneumonia is the type of the disease present after the third year, if those cases secondary to some other condition or those in which the pneumonia occurs as a terminal condition are omitted. Lobar pneumonia *per se* is a common condition in the first and second years of life, being much more frequent than is commonly supposed. The etiological factor in lobar pneumonia is always the pneumococcus, while a bronchopneumonia may be due to a number of organizations, such as the streptococcus or the influenza bacillus, occurring alone or as a mixed infection. If pneumococci are present in bronchopneumonia, they are usually one of a group of organisms usually found in the mouth.

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[1] Archives of Pediatrics, May, 1915.

The pneumococci may be divided into four general groups, each being made up of many races which are closely related. A pure culture of pneumococcus may be obtained and the group determination completed within twenty-four hours from any given case of pneumonia. The division of the pneumococcus into groups is of great importance from the standpoint of treatment, since a serum or vaccine prepared from organizations of one group are not applied in the treatment of a pneumonia due to organizations of another group. It is hoped that the division of pneumonia into groups will eventually bring about the treatment by means of specific sera or vaccines, thus replacing the symptomatic treatment of today.

A series of 104 cases of pneumonia treated in the Boston Dispensary is reported by Dana.[1] The age of these patients ranged from one to twelve years, 46 being one year or under. He reports the remarkable mortality of 2 deaths in 102 cases. The routine of treatment employed was as follows: Fresh air constantly. Often a child can be kept better covered and warmer if it be bundled fairly tightly into a baby carriage or a clothes basket than if kept in bed. Food is extremely important. Small amounts of liquid or solid food can be given to the child, and, if repeated often, considerable nourishment can be given. Long, slow, hot normal saline irrigations of the bowels once or twice a day are useful as a means of stimulation, to give water to the body, to reduce toxemia, and also for cleansing purposes.

Cold applications to the chest may be accomplished by wringing cloths out of cold water, applying them to the skin, covered over with newspaper to protect the clothes. These applications should be renewed when they become warm. Children should receive a tepid sponge bath, preferably followed by an alcohol rub, twice daily if the temperature reaches 102° F. When the temperature is high or long continued, Dana is personally in favor of large doses of brandy, perhaps twenty to fifty drops every two hours for a child one to three years old.

As a routine all these patients were given ammonium chloride and syrup of ipecac, using the fluidextract of glycyrrhiza as a vehicle. For a child under one year, Dana uses a quarter to a half drop of ipecac each two hours. For all children over one year, he gives a drop of ipecac for each year of the child's age, every two hours, and a grain of ammonium chloride every two hours for a child from one year to twelve years old. If a child is very sick it is given tincture of belladonna, a quarter- to a half-drop up to eighteen months of age, and one to one and a half drops for older children each two hours.

One is driven to wonder why fluidextract of glycyrrhiza should be used as a vehicle in prescribing ammonium chloride. It is without therapeutic effect and few other preparations are so effective in destroy-

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[1] Boston Medical and Surgical Journal, January 14, 1915.

ing the appetite and upsetting the digestion. I feel impelled to ask these questions because it seems to be the universal feeling that this nauseating drug must be used with ammonium chloride. It is frequently stated that chloride of ammonia is irritating to the stomach. This is not the case. The digestive irritant is usually the vehicle that is used with it. A grain of ammonium chloride, as advocated by Dana, dissolved in a teaspoonful of water is almost tasteless and rarely irritates the stomach of the most delicate infant. The administrating of nauseous vehicles with almost tasteless drugs ought to be frowned upon.

In discussing the treatment of bronchopneumonia, Baginsky[1] makes an effort to impress on young physicians that the child has generally an intact organism, strong to resist and well equipped against pathogenic damage, infections, and intoxications. It reacts, as a rule, in a most gratifying way to slight therapeutic measures. Strong drugs and methods are rarely required. The main point is to trust nature's recuperative powers in general, watching to reinforce her when she is not quite competent alone, always bearing in mind that for children we must refrain from doing harm by any unnecessary interference.

**Acute Bronchiectasis in Children.** This subject is considered editorially[2] with special reference to the complications which may arise. The real complication of acute bronchiectasis is the evolution of the process toward chronicity, which is unfortunately frequent. The bronchial tubes being particularly sensitive, the tubercle bacillus finds favorable soil for development. When this complication occurs, it assumes a slowly progressive course without any tendency to acute miliary outbreak. It is at the terminal period of the bronchial dilatation that gangrene of the mouth and hypertrophic osteitis supervene. The former complication is, according to Delacour, peculiar to childhood and is met with more frequently in females.

The buccal lesion cannot be said to belong exclusively to the bronchiectasis, since it is encountered in other wasting diseases. This also applies to the Hippocratic finger, which may exist in any chronic disease of the respiratory apparatus. Acute bronchiectasis in children possesses no pathognomonic symptoms, so that diagnosis is often difficult, and consequently the age and antecedent history of the patient, the evolution and peculiarities of the disease, as well as the preponderance of any symptom which characterizes a series of clinical types, must be taken into consideration. During the progress of the acute stage of bronchiectasis, it is usual to find pulmonary and peribronchial congestion, giving rise to serious general symptoms, but this is a symptom rather than a complication.

Complications in acute bronchiectasis, in the true sense, are uncommon in children, but pulmonary gangrene and even abscess have been

[1] Arch. f. Kinderheilkunde, 1915, lxiv.
[2] New York Medical Journal, October 16, 1915.

observed, as well as pyemia in various forms, giving rise to septic joints, hepatic abscess, cerebral abscess, suppurating meningitis, and ulcerating endocarditis. Severe hemoptysis is exceptional in young subjects, but it has been observed. The same may be said of emphysema, but the contrary is true of pleurisy, which may be either serous or purulent.

Enlargement of the intertracheobronchial glands is almost always present, according to Triboulet, and controls another complication, namely, tachycardia, which in itself has a certain diagnostic value. Hypertrophy of the lymph nodes in varying degrees has always been noted in autopsies after infantile bronchiectasis, and must be distinguished from tuberculous infection, which invades the patient secondarily. In simple hypertrophy, the glands are quite large, having undergone marked fibroid degeneration without any trace of tuberculous process.

**Imperfect Digestion in Infants.** One of the most difficult conditions the practitioner is called upon to meet is weak and imperfect digestion in infants and young children. In few other conditions are knowledge and ingenuity so necessary. Any suggestion, therefore, is gladly accepted. A paper on the influence of posture on the digestion in infancy by Smith and Le Wald[1] offers some valuable suggestions. It is profusely illustrated by $x$-ray plates which make the views advanced more clear. The following conclusions may be drawn from their studies: Air is swallowed with the food by many, if not all, infants. The erect posture favors the eruction of this air; the horizontal posture prevents it. The horizontal posture, by preventing this eruction, is an important cause of vomiting, colic, indigestion, and disturbed sleep.

The following routine should be followed in feeding every infant: Before feeding, the infant should be held upright to allow the escape of any gas present in the stomach. Immediately after feeding the infant should be again held up against the shoulder of the mother or nurse. He may be patted on the back or gentle pressure may be made on the epigastrium to encourage eruction of the swallowed air. It may be necessary to interrupt the feeding one or more times to hold the child upright to eructate, in cases in which an excessive amount of air is swallowed. After the gas is eructated the child should be laid down to sleep, preferably in a prone position with the head of the bed raised. If restless, he may be taken up after a short time to see if there is more air in the stomach. Habitual tongue-suckers need to be held up several times between feedings, as they constantly swallow air. Other suckling babies must be prevented by mechanical restraint. Feedings should be given at as long intervals as possible, depending upon the gastric capacity and the total daily requirements. A feeding should not be taken too slowly. From five to ten minutes are enough as a rule.

[1] American Journal of Diseases of Children, April 15, 1915.

Fifteen minutes should be the maximum time at bottle or breast. The importance of posture and the wrong instruction given to physicians and nurses in the past warrant the emphasis laid on so simple a matter.

The use of mineral oil in these conditions of chronic dyspepsia in childhood has been studied by McNeil.[1] The action of this oil is apparently local on the mucous membrane of the digestive tract. He is of the opinion that the emulsion of liquid paraffin or of castor oil in small and non-purgative doses are of perceptible value in the treatment of various and apparently distinct types of chronic dyspepsia in childhood. In a great majority of these diverse types of illness there is an abnormal condition of the stools; this may often be a true diarrhea, but not seldom also merely a too soft consistence of the stool, with or without the presence of mucus. A large number of these cases follow the infective fevers of childhood, especially measles and whooping-cough. The action of liquid paraffin and castor oil is similar; they are entirely local in their action.

In discussing the subject of dyspepsia in infants, Langstein[2] asserts that when the child with dyspepsia is put on breast milk, the weight continues to decline and the child to look sick during the course of two, three, or four days. The weight drops off the faster, the larger the portion of carbohydrate and whey in the previous food. The loss is seldom over 300 or 400 gm. If the sickness lasts over three or four days further steps must be taken to check the fermentations, and preparations of albumin may be added to the breast milk. If the infant has been getting artificial food, nothing but water must be allowed for twelve to twenty-four hours; then food mixtures can be given, remembering that the sugar and whey are what keep up the fermentations, hence they should be kept down to minimum. He suggests four forms of food: Diluted milk with dextrin malt; rice or oatmeal, not allowing over 1 or 2 per cent. of the carbohydrate; gruel with from 1 to 2 per cent. flour, to choke out the fermentation, suitable only for older infants. The third type is diluted milk enriched with albumin, with little or no carbohydrate. The fourth type includes albumin milk; buttermilk without sugar but enriched with some form of flour or with cream; half-and-half kefer, or, best of all, albumin milk. After twenty-four hours of tea diet one of the above mixtures is given, to a total of 200 or 300 gm. in the course of five or six feedings. In two or three days the weight begins to increase. The child should not be kept on the starvation diet longer than twelve or twenty-four hours.

When the dyspepsia is of infectious origin, it becomes especially important to restrict the diet to check fermentations, and ward off or cure vomiting or anorexia. Vomiting is a reliable symptom of

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[1] Edinburgh Medical Journal, February, 1915.

[2] Therapeut. Monatsh, July, 1915; Journal of American Medical Association, September 18, 1915.

infectious dyspepsia, and it may require some sedative to reduce the hyperesthesia of the gastric mucosa that is keeping up the vomiting, which in itself testifies to the infectious nature of the trouble. The best means to combat it, he declares, is a sedative to reduce the hyperesthesia of the gastric mucosa, such as novocain, 0.001 gm. at a time, four or five times a day before feeding. Rinsing out the stomach once or twice is also useful. Anorexia is more a sign of a neuropathic constitution than of dyspepsia. If it persists the child should be fed forcibly. Feeding through a tube is a harmless and useful procedure. It can be repeated three or four times a day, giving water still more frequently. If a child refuses water, it is best instilled in the rectum.

**Intestinal Parasites in Children.** There can be no question that intestinal parasites play an important part in modifying the nutrition of young children. Not only may they cause grave malnutrition to the child, but they may be predisposing causes to intestinal diseases. McNeil[1] seems to have demonstrated that both the pinworm and the whipworm may be causative factors in cases of acute and subacute appendicitis. The locality in which observations are made must of necessity make radical differences in the results reported. Certain worms may be found in one part of the country which are never known in another. Careful observations are reported by Greil,[2] of Montgomery, Ala. In that locality, as might be expected, he found a predominance of hookworms. The total number of children examined was 665, of whom 80 were negroes, and all were under twelve years of age. Of this number, 240 were found to be infected, 425 were negative. That is, 36.1 per cent. of the children were found to harbor one or more of the varieties of parasites as follows:

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|---|---|---|---|---|---|---|
| Hookworms | 117 | (62 females | 115 males) | 26.75 per cent. |
| Hymenolepis nana | 38 | (20 " | 18 " ) | 5.75 " |
| Ascaris lumbricoides | 27 | (12 " | 14 " ) | 4.06 " |
| Oxyuris vermicularis | 5 | ( 3 " | 2 " ) | .75 " |
| Trichocephalus dispar | 5 | ( 2 " | 3 " ) | .75 " |
| Mixed infections, 2 or more parasites | 12 | ( 6 " | 6 " ) | 1.80 " |

The conclusions to be drawn from Greil's observations are that parasitic infections in children are far more common than has hitherto been thought, at least in the Southern States; that while hookworm infection is most often found, hymenolepsis nana and trichocephalus dispar are by no means rare; that less than 10 per cent. of the cases infected complain of symptoms referable to the infection; that by routine examinations, many cases will be found otherwise unsuspected, and by thorough treatment their general condition will be greatly

[1] Southern Medical Journal, June, 1915.
[2] American Journal of Diseases of Children, November, 1914.

improved; that every county and municipality should appoint a physician for special work along this line, to follow the work done by the Rockefeller Hookworm Commission and under the direction of the State health officer, who should at frequent intervals examine the feces of every child in his district. No child should be permitted to attend a public or private school until after such an examination and the results prove to be negative.

**Constipation in Infants.** Few conditions are more trying than the persistent constipation of infants. When the case is persistent and extreme and relief is not obtained by changes in the diet, medication is but temporary in effect, and the cautious physician dislikes to adopt it alone. J. P. Crozer Griffith[1] offers some useful suggestions. Of purgative drugs, which should be but temporary makeshifts, he feels that the preparations of cascara are the best, and with them may be combined phenolphthalein or senna. Paraffin oil has come into prominence of late and is useful in many cases. It may be given undiluted if children will take it, or mixed with peppermint or other flavoring substance. He speaks of a method he has found serviceable in obstinate constipation combined with symptoms of chronic intestinal indigestion. These cases are very troublesome, and are often attended by a large array of other morbid conditions, which the relief of the constipation will cure. Just before retiring the child should be given a rectal injection of several ounces of olive, cotton-seed, or other bland oil. From four to eight ounces may be employed, depending on the age of the patient or its tolerance. This oil should be retained in the bowel overnight, and will be so in the majority of cases, except in quite young children. In the morning the child visits the toilet, when he will generally have a movement without trouble, the feces now being in quite a soft state. If there is difficulty on account of lack of peristalsis, on first arising in the morning he may take a small amount of saline laxative, such as Apenta water. This soon suffices to produce an evacuation and generally after a short time the giving up of the saline may be omitted, the oil alone being found sufficient. Of course with this treatment dietetic and hygienic measures are to be carried out, together with the administration of such remedies as nux vomica and soda in combination.

**The Diarrheas of Children.** These conditions continue to attract the attention of the profession, but new ideas regarding them are rarely found. Howland and Marriott,[2] in speaking before the American Pediatric Society on the subject, considered a type of diarrhea in young children which is universally recognized as especially serious. It is particularly liable to occur in those who are undernourished. After perhaps a few days of mild diarrhea, the stools become large, watery,

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[1] Therapeutic Gazette, April, 1915.
[2] Archives of Pediatrics, May, 1915.

and frequent. The infants are at first restless and sleepless; later, stupor frequently develops and oftentimes coma. The urine is scanty and extremely acid, frequently containing albumin and casts, and sometimes sugar. Respiratory symptoms are often present, especially toward the close of the disease, but there is no cyanosis. Postmortem examinations show insignificant lesions. This type of diarrhea has been called "toxicose" by Czerny and "alimentäre intoxikation" by Finkelstein. During the past summer, many determinations were made with reference to the alimentary air. The carbon dioxide tension was found to be much lower than in health, and the more severe the dyspnea the lower the carbon dioxide tension. It was found also that when improvement took place the tension rose. As low carbon dioxide tension is one of the evidences of an acidosis, other evidences of this were sought. The blood serum was examined by the phenolphthalein test of Sellards, and it was found that in infants with severe diarrhea a change could be noticed varying from slight diminution in the color to complete absence of color. The hydrogen-ion concentration of the serum was also investigated and found to be increased. These infants had a very marked tolerance for alkalies, whether given by mouth, intravenously or subcutaneously; three, four, or even five times as much alkali had been required to cause an alkaline urine as in health. There was also evidence afforded by the influence of the alkali when given subcutaneously or intravenously. When the alkali had been taken in sufficient amount it caused the Sellards test to give a deep purple with phenolphthalein, stopped dyspnea, and caused a return of the carbon dioxide tension of the alveolar air to normal or even abnormally high limits. An examination of the urine for acetone bodies was usually without result. In view of these findings, it seemed fair to say that these patients suffered from acidosis and from a very severe acidosis. The acidosis was probably a relative one caused by the loss of alkali from the intestines. It seemed, therefore, bad practice to give cathartics which would irritate an intestine already too irritated and cause a loss of material from the bowel which it is vitally necessary for the infant to retain. Unless an infant is distended, cathartics are contra-indicated; opium should be given in amounts only sufficient to diminish the excessive diarrhea.

It is necessary to give soda by the mouth, by rectum, intravenously, or subcutaneously. The intravenous is the method of choice if a vein is accessible. It should be given in large enough doses to cause the cessation of the dyspnea and give an alkaline urine. This method of treatment improves the likelihood of recovery but does not mean that recovery will inevitably ensue. Severe acidosis might be combated and yet death might take place. This condition should not be termed "food intoxication." It is not due to the presence of abnormal substances, but to the absence of substances that are very normal and necessary to life.

In discussing the subject, Koplik,[1] of New York, said that he had always taught that opium is a very dangerous drug and that it is difficult to gauge the dose in severe cases of diarrhea in infants and children. He did not see why one should stop the diarrhea and the peristalsis which is the means by which nature eliminates a noxious substance which would otherwise be absorbed into the circulation and increase the difficulties. Kerley, of New York, said that opium is one of the best of drugs if used in the right way. Drainage must be maintained but not to the point of exhaustion. Opium is indicated in moderate doses sufficient to control the diarrhea. Blackader, of Montreal, said one could do almost anything with opium. By giving small doses one can give the digestive fluids a chance to act and favor absorption. Large doses of cathartics exaggerate the diarrhea and hurry the intestinal contents on through the digestive tract and the large bowel. Opium in doses sufficient to control the extreme peristalsis does a great amount of good in these cases. Koplik's statement, he thought, ought not to go out without some modification. Morse, of Boston, said that it seemed to him that the question whether opium is indicated in diarrhea or not depended upon the circumstances in the individual case. If there is something in the bowel, then a cathartic is indicated. If, on the other hand, the diarrhea is simply draining the tissues, then opium should be given. Howland, of Baltimore, said if a child has a disturbance accompanied by high fever and the intestines are filled with fermentative and putrefactive substances, then opium should not be employed; but if there was nothing in the intestinal tract and the diarrhea is a protective process carried to the extreme and accompanied by the excretion of a large amount of alkali which is causing the symptoms, then opium should be given, not sufficient to cause the child to go into coma, but in small quantities, a few drops after each loose stool. It is surprising how much opium these children can take without influencing their stupor. He gives 4 grams of alkali at a time subcutaneously, 5 or 6 grams intravenously, and 3 or 4 grams by the mouth at one time. The diet is extremely difficult to manage. The majority of these children die, but with intelligent treatment it is possible to save more than if the indications for treatment are disregarded.

In studying the *relation of the gas bacillus to infectious diarrhea* and other disturbances, Silvester and Hibben,[2] of Boston, say that in the course of their investigations it became apparent that the work must not be limited to infectious diarrhea alone. It should be extended to embrace the following conditions: Infectious diarrhea, characterized by fever, prostration, and frequent stools, consisting largely of mucus and blood, due to infection of intestinal tissues by pathogenic organisms; fat intolerance, characterized by the inability of the individual to digest

[1] Archives of Pediatrics, May, 1915.          [2] Ibid., June, 1915.

normal amounts of fat; carbohydrate intolerance, characterized by the inability of the individual to digest normal amounts of carbohydrates; chronic intestinal indigestion, sometimes called malnutrition or marasmus, characterized by the inability of the individual to digest any or all of the three principal elements of food in normal amounts.

After extended study they conclude that the gas bacillus is not a normal inhabitant of the intestinal tract. Its pathogenicity is apparently demonstrable in certain cases of infectious diarrhea, fat intolerance, carbohydrate intolerance, and chronic intestinal indigestion. The dietary treatment by means of fat-free lactic acid milk unpasteurized, by imposing conditions unfavorable to the growth and activity of the gas bacillus, is rational, safe, and more immediately effective than other treatment so far advocated.

In writing upon the classification and diagnosis of diarrheas in bottle-fed infants, Morse[1] considers the various forms of infectious diarrhea. The microörganisms which produce the disease are of several types. They are divided roughly into three main classes: The dysentery bacillus in all its forms; the gas bacillus and similar organisms; other organisms of which the most important are streptococci, the colon bacillus, and the Bacillus pyocyaneus. The symptoms produced by these different types of organisms are practically identical. It is usually impossible to determine from them which type is causing the disturbance. The microscopic examination of the stools is of very little assistance in differentiating the various types unless the streptococcus is the cause, in which case it is usually present in large numbers and easily recognized.

The presence or absence of the gas bacillus can be determined in from eighteen to twenty-four hours by the following method, which is simple and can be carried out by anyone: A small portion of the stool is added to a test-tube of milk. The infected tube is then brought to the boiling-point of water in a water bath and kept there for three minutes. In this way all the bacteria not in the spore state are killed, and whatever spores may be present develop into vegetative cells unrestrained by the presence of non-spore-forming organizations. The tube is then incubated at body temperature for from eighteen to twenty-four hours. When the gas bacillus is present the casein is largely dissolved; the residual casein is somewhat pinkish in color and filled with holes; the odor of the culture is much like that of rancid butter, as the result of the formation of butyric acid by the gas bacillus. Gram-stained preparations made from the milk show rather thick, short, Gram-positive bacilli, with slightly rounded ends. The fermentation is more easily observed if the milk, after being boiled, is put in a sterile fermentation tube. There is, unfortunately, no method of determining the presence or absence

[1] American Journal of Medical Sciences, January, 1915.

of dysentery bacilli which does not require special media and a fairly well-equipped laboratory.

*Infectious diarrhea* in infancy is always a serious disease. The prognosis should be a guarded one. It is impossible to know in the beginning what the result will be. Death may occur in three or four days, but most often takes place during the second week of the disease. It may be delayed, however, for several weeks. Improvement usually begins in the cases which recover at the end of the first or the beginning of the second week. Recovery is slow and likely to be interrupted by relapses. Symptoms which render the prognosis more serious are high fever, the presence of much blood in the stools, and the appearance of the symptoms of marked toxic absorption, such as persistent vomiting, marked restlessness, and convulsions. The presence of albumin and other evidences of degeneration of the kidney in the urine are not of specially bad diagnostic import.

The first thing to be done in infectious diarrhea is to thoroughly clean out the intestinal tract. The best drug for this purpose is castor oil. It works quickly, thoroughly, and causes less irritation of the intestines than other cathartics. The dose should not be less than two teaspoonfuls. It should be given plain. Castor oil should be tried first, even if the baby is vomiting, because it is often retained when food and water are vomited. If it is vomited, calomel may be given in its place. The usual dose is 0.1 grain, combined with 1 grain of bicarbonate of soda, every half-hour until 1 grain or 1.5 grains have been given. It is wise to follow it with two or three teaspoonfuls of milk of magnesia in two or three hours after the last dose. The lower bowel should be irrigated at once with physiological salt solution.

All food should be stopped for from twelve to twenty-four hours. It is not desirable, as a rule, to withhold food longer than this time. It is necessary, however, to give water freely during this period. It may be given either warm or cool, and may be sweetened with saccharin if desired.

The most important element in the treatment of infectious diarrhea is the *diet*. The character of the diet depends on the character of the microörganism which is causing the disease. The microörganisms can be divided, so far as the determination of the diet is concerned, into two groups: The various forms of dysentery bacillus and the other organisms, except the gas bacillus, which cause the disease: the gas bacillus and its allied organisms. The other organisms, although of different varieties, are grouped with the dysentery bacillus, because as regards their growth and the production of their toxic substances from protein and carbohydrate media they behave in the same way. The dysentery bacillus, the colon bacillus, and the streptococcus belong to the class of facultative bacteria. This class of organisms can thrive upon either carbohydrate or protein media. They produce harmless products

from carbohydrates and toxic substances from protein. They act upon and use up the carbohydrate material before they take the protein, when both are present in the medium in which they are growing. The products of the breaking down of the carbohydrate material have, moreover, when produced in sufficient amounts, an inhibitory action on the development of dysentery bacilli and, to a less extent, of streptococci.

It is evident, therefore, that when diarrhea is caused by bacteria of this type the food should be largely carbohydrate in character. In this way the organisms are prevented from forming toxic substances, and their growth is, to a certain extent, inhibited. The prolonged withdrawal of food is contra-indicated, because the intestinal contents are then made up entirely of the intestinal secretions, which are protein in character. Some form of carbohydrate should therefore be given after a few hours. Sugar is preferable to starch, because it is much more easily utilized by bacteria. Lactose is preferable to the dextrin-maltose preparations, because it is more slowly broken down during the process of digestion. Being less readily absorbed, it thus provides a carbohydrate medium in the intestine for a longer time than the dextrin-maltose combinations. It is probable, moreover, that a larger proportion of lactic acid is formed from milk-sugar than from other sugars, and lactic acid has an inhibitory action on the development of the dysentery bacillus. The lactose should be given in the form of a 5 per cent. or 7 per cent. solution in water. It is better to give it frequently in small amounts than in larger amounts at longer intervals, because in this way a continuous supply of lactose is brought to the intestines. The baby should be given at least as much of the sugar solution as it would take of food under normal conditions. Half as much more is usually advisable. There is little or no danger of producing sugar indigestion or glycosuria if no more than this is given.

After twenty-four to seventy-two hours it is wise to give the milk sugar in barley-water. The barley-water should contain from 0.75 per cent. to 1 per cent. of starch. The starch provides more nourishment and, being still more slowly broken up and absorbed, favors still further the prolonged continuance of a carbohydrate medium in the intestine. It is necessary to add some protein to the food as soon as possible in order to neutralize the protein waste of the organism. It should be given as soon as there is evidence of improvement in the condition. Care should be taken not to give so much as to neutralize the action of the carbohydrates. It is usually safe to begin with 0.5 per cent., increasing the amount 0.25 per cent. at a time as fast as possible up to about 1.5 per cent. It may be given either in the form of whey, protein, or casein. If it is added in the form of casein, the mixture should be boiled in order to prevent the formation of casein curds. No fat should be given until convalescence is well established.

The gas bacillus and allied organisms grow rapidly in the intestinal tract when there is an excess of utilizable carbohydrate in the bowel, and at the same time an insufficient number of those organisms which form lactic acid from carbohydrates to produce enough lactic acid to inhibit their growth, the gas bacillus being sensitive to lactic acid. The indications to be followed in the treatment of cases of infectious diarrhea caused by the gas bacillus are, therefore, to cut down the carbohydrates in the diet and to introduce lactic-acid-producing bacteria in the bowels. These indications can best be met by the use of unheated buttermilk or, better, of mixtures containing no fat, 3 per cent. or 4 per cent. of milk-sugar, and from 1.5 per cent. to 2.5 per cent. of protein, ripened with lactic-acid-forming organisms. It is not possible to cut out the sugar entirely, because if this is done the lactic-acid-forming organisms will have nothing on which to grow. The lactic acid already present in the food exerts an immediately inhibitory action upon the gas bacillus, while the lactic-acid-forming organisms in it, by keeping up their production of lactic acid, continue this action. They also use up the available supply of carbohydrate and thus interfere with the growth of the gas bacillus. Lactic acid given by the mouth is much less affective, because it is rapidly broken down and absorbed, and therefore does not have a continuous action. Pasteurized buttermilk, in which the lactic-acid-forming organizations are destroyed, is less valuable than raw buttermilk for the same reason.

Cutting down the carbohydrate in the diet and increasing the amount of protein in it is sufficient to relieve the condition in mild cases. The percentage of fat should also be kept low. Mixtures containing from 1 per cent. to 1.5 per cent. of fat and from 1.5 per cent. to 3 per cent. of protein, and with no more milk-sugar than is necessarily added in the milk and cream to give the desired percentages of fat and protein, are suitable ones. It is well to boil them in order to prevent the formation of casein curds.

It is evident that the line of diet which is suitable for one type of infectious diarrhea is not only not suitable, but absolutely harmful for the other, and *vice versa*. It is extremely important, therefore, not to make a mistake in the choice. It is unfortunately almost impossible to determine at once what form of microörganism is the cause in the individual case. A point of some assistance in arriving at a tentative conclusion is that in a given season the vast majority of cases of infectious diarrhea are due to the same organism. If the prevailing organism is known, therefore, the chances are that this organism is the cause in the given case.

*Irrigation of the bowel* once or twice in the twenty-four hours is a useful procedure. The object of the irrigation is simply to cleanse the colon. It is impossible to use any astringent solution strong enough to have an appreciable action or any antiseptic capable of destroying the patho-

genic bacteria without running serious risk of poisoning the baby. The irrigation solution should therefore be some mild unirritating solution, such as physiological salt solution or a 1 per cent. solution of boracic acid. The irrigation should be given with a soft-rubber catheter, No. 25 French, passed as high as possible into the bowel, with the patient lying on the back and the hips elevated. The fluid is then allowed to run from a bag not more than two feet above the level of the patient.

There is no *serum* which is of any value in the treatment of infectious diarrhea. Pain and tenesmus are often troublesome symptoms. Injections of two ounces of starch solution, of the strength of one dram of starch to one ounce of water, to which are added from two to three drops of laudanum, will sometimes control the tenesmus. They are usually expelled, however, before they have had time to do any good. It is generally wiser, therefore, to give the opium by mouth if it is necessary to use it at all. It must be remembered when giving opium that its tendency is to reduce peristalsis, and that if the peristalsis is diminished enough to interfere with the free emptying of the bowels, serious harm will be done. Only sufficient should be given to allay the tenesmus and prevent the frequent stools due to excessive peristalsis.

**Dietetic Malnutrition in Infants.** Malnutrition in infants may be due to hereditary weakness, environment, and numerous other causes, but by far the greater number of cases are due to errors in feeding. These errors are due either to improper food or to its improper preparation. Malnutrition due to dietetic errors is very judiciously discussed by Brundage,[1] of Buffalo. There are gradations in this condition of dietary malnutrition which may be classed in three groups: The first is that of the mild malnutrition of the breast fed. The weight is about two pounds under the average; the muscles are somewhat flabby; there is mild anemia; the child is restless and irritable. It usually occurs at three periods, at two months of age, whem the mother has tried to nurse and is unsuccessful; at six months of age, when the breast supply naturally begins to diminish in quantity and quality; and at fourteen or fifteen months, when the nursing is prolonged without other food. Many of these cases develop the early symptoms of rickets.

The second class is the moderate degree of malnutrition in the bottle fed. These babies have been fed on one or two foods for a considerable length of time. The first food not producing a satisfactory weight another is tried with the same result. The foods are ordinarily well digested and the child is fairly comfortable, yet the weight is stationary or very slight. The addition of cow's milk to the dietary of these cases is all that is necessary. At the beginning all amounts should be conservative and increased as the toleration increases. A baby moderately hungry for a day or two is far better off than one almost killed by kindness.

[1] New York State Journal of Medicine, March, 1915.

The third class is characterized by a constant loss of weight, anemia, flabby muscles, vomiting or diarrhea, and constant crying. Many of these cases are either luetic or tubercular, but give no definite symptoms or positive reactions.

**Acidosis in Children.** A study of 100 consecutive cases of auto-infection in infants occurring in epidemic form is reported by Metcalf,[1] of Concord. The disease was seen in all degrees of severity. Mild cases yielded very quickly to treatment. Severe cases were pernicious in their activity. Fatal cases were malignant. The average duration of the fatal cases was thirty-two hours, the two extremes being sixteen hours in a baby fourteen months old and sixty hours in a child of five years. The more severe the attack, the greater was the prostration and wasting, and the more evident the meningeal symptoms. So great was the loss of fat in fatal cases that children in relatively few hours shriveled from plumpness to emaciation. With sunken eyes, hollow cheeks, and tight-drawn skin, they looked not unlike patients in the last stages of phthisis. In such cases, delirium and convulsions occurred.

A coated tongue, a flushed face, drowsiness, and thirst were frequent during the active stage of illness. The type of air hunger peculiar to the disease occurred without cyanosis, but cyanosis did not occur without air hunger. Rarely a child's face showed complete pallor. Mouth pallor did not occur unless the face was flushed, but, on the other hand, many flushed faces showed no mouth pallor. Retraction of the abdomen was observed only in the more severe and protracted cases. Abdominal pain was infrequent, as was enlargement of the liver. Icterus, with clay-colored stools, was not nearly so common as other accounts would lead one to anticipate. One child exhibited a punctate red rash on the second day of disease, otherwise skin lesions and pruritus were lacking. In few more than a third of these cases was diarrhea observed. Blood was almost never present. Normal or constipated stools, which prevailed in two-thirds of the cases, were brown, yellow, or black. Watery stools had little odor; those that were solid or semisolid were usually foul, and in all but one case in which the reaction was tested it was strongly acid. In 7 cases vomiting was absent. Normally, it was a predominant feature; food first, changing quickly to watery, mucous fluid, either colorless or yellow, like thin pea soup. It was propulsive in character.

The following is a list of symptoms in the order of frequency of occurrence: Coated tongue, 92; thirst, 79; flushed face, 74; drowsiness, 64; marked prostration, 41; diarrhea, 35; wasting, 26; air hunger, 25; mouth pallor, 23; nervousness or activity, 22; cerebral symptoms, 18; cyanosis, 16; clay-colored stools, 7; retracted abdomen, 6; icterus, 4.

In this series, treatment comprised the administration of alkalies by

[1] American Journal of Diseases of Children, January, 1915.

mouth or by rectum, catharsis, rectal irrigations, and the regulation of diet. Soda was retained well in all but one of the fatal cases, although persistence of vomiting was expected until several doses had been given. The stomach proved tolerant of large amounts of soda. Certain children preferred the dry salt; they deposited a teaspoonful on the tongue and washed it down with a swallow of water, nevertheless concentrated solutions tended to irritate the stomach and cause a recurrence of the vomiting. By concentrated solution is meant one stronger than 1 to 20: a dram of soda to two and a half ounces of water. This ratio and the ratio 1 to 32 and 1 to 60 never caused nausea. Children who received a dram of salt each hour or two acquired an alkaline urine in from twenty-four to thirty-six hours. The author believes that it is proper to make a solution in the ratio of 1 to 20 Of this solution half an ounce may be given every twenty minutes. One must often vary the dilution and the frequency of administration, but he should give the drug freely and in as concentrated a form as is well borne. Edsall's minimum dosage (100 grains of the bicarbonate) given as rapidly as possible, is much less than was used for many of these cases. The same may be said of Rachford's suggestion that eight or ten grains be given every two or three hours and of Koplik's small dosage. Water proved the most satisfactory solvent for soda. Attempts to disguise the flavor of the salt with orange-juice or grape-juice were usually unnecessary. Of the two, orange-juice was preferable.

Sodium bicarbonate was given by rectum in thirty-two instances; half a dram of salt in two ounces of water was injected every hour or two. It was retained in eighteen. A saturated solution given by the drop method, at the rate of a drop per second, could be continued from twelve to twenty-four hours. Potassium citrate and sodium citrate were the alkalies of second choice, used both in conjunction with the bicarbonate and alone. Some children could retain them who could not retain the bicarbonate; the reverse was occasionally true. Citrates may be given to the amount of half a dram or a dram every hour, in a concentrated solution, one ounce of salt to four of water. So given one procures an alkaline urine in less than twenty-four hours, and with these drugs alone one may conquer an acidosis with auto-intoxication.

**Allergy to Foods.** Much attention has been given during the last year or two to the subject of allergy to certain foods. One of the first to study this subject carefully was Schloss,[1] of New York. His last paper records a study of 43 cases of food idiosyncrasy. Among these were cases of idiosyncrasy to milk, egg, beef, horse protein, wheat, rice, and other cereals and foodstuffs. It was unusual to find the idiosyncrasy confined to a single food substance, but, as a rule, it was confined to several of those enumerated. Among the most frequent symptoms

[1] Archives of Pediatrics, May, 1915.

due to food idiosyncrasy were urticaria and angioneurotic edema. In some of the severer types those symptoms followed immediately after the ingestion of the toxic food, affecting the lips and buccal and pharyngeal mucous membranes. The more remote might follow from one-half to three hours. Schloss has observed 18 cases of pronounced eczema, and in every case a cutaneous reaction was caused by the proteins of one or several foods.

A second group of toxic disturbances consists of asthma or asthmatic bronchitis. Cases of asthma provoked by the ingestion of egg are not uncommon, and while asthma may be due to the ingestion of other foods, the relationship was far from constant, and in a number of cases in which such a relationship was suspected, investigation gave only negative results. A third group of symptoms are gastro-enteric in origin. Vomiting, pain, and diarrhea are probably due to the irritant action exerted by the foods. In the fourth group the food idiosyncrasy is indicated by the blood reaction, which consists of eosinophilia.

With reference to the cutaneous action, Schloss states that in the more pronounced cases, simple massage of the food or protein into the skin caused the appearance of crops of urticarial wheals. Inoculation of the food into a skin abrasion caused the appearance of an urticarial wheal surrounded by a zone of erythema. The reaction was characteristic, and so far as has been determined, occurred only in cases of food allergy. In human beings, patients once immunized to egg do not remain immune unless egg in comparatively large amounts is administered continually. In 6 patients the immunity seemed to be lost in from three to six weeks, when the further ingestion of egg protein in gradually increasing amounts again produced immunity. In some instances the food idiosyncrasy was inherited, while in others it was acquired.

The diagnosis of food allergy is made either clinically or by the cutaneous reaction, and the treatment must vary according to the type of the idiosyncrasy. The ideal method is that of desensitization by the administration of gradually increasing amounts of the toxic protein. The second method is that of eliminating the offending articles from the diet. Often the two methods may be combined with advantage. At present, experience does not warrant the assertion that a satisfactory result can be obtained in all cases in which it is reasonable to suppose that the disease is of food origin.

In discussing the subject, Howland, of Baltimore, said that during the past few months Dr. Blackfan has investigated 23 cases of eczema. Almost all of them were sensitive to one or more proteins; almost all were sensitized to egg, many to milk, and 2 or 3 to cereals. It had been impossible to produce passive immunity, and tests showed no precipitins in the blood. These children responded rapidly to treatment, but there was usually a return of the symptoms. Among the older children a few were entirely cured.

Talbot, of Boston, said he had been following Dr. Schloss's work and had been making observations of his own. His results had been the same as those of Dr. Schloss. The longest time a patient had remained absolutely cured was three years; several children had lost the skin reaction. He has seen a large number of cases of asthma recently and about 60 per cent. had a positive skin test to some food. He has found that egg was the offending article most commonly, and with egg allergy there was sometimes a reaction to nuts, and of these especially English walnuts. In several instances he had made the tests with several kinds of nuts; more frequently the peanut was the one that did not produce a reaction when others did. Many that reacted to egg were also sensitive to horse serum. In the majority of cases there was a definite history of intolerance either in the father or mother, or both.

**Breast Feeding.** A chemical study of woman's milk, especially of its organic constituents, is reported by Holt, Courtney, and Fales.[1] It is an intricate article illustrated by extensive tables, from which the following conclusions may, apparently, be drawn: The use of large individual samples of milk for analysis has advantages not offered by small ones as have been commonly employed. In the colostrum period woman's milk has high protein and high ash with rather low fat; in the transition period the protein and ash are lower while the fat is higher. After one month the composition of normal milk does not vary in any essential or constant way up to the end of lactation. The only striking feature of late milk is a decline in quantity, though there is noted a slight fall in all the constituents except the sugar.

Of the different constituents of milk, the least variation both in individuals and periods is seen in sugar. The proportion of this is somewhat higher than the generally accepted 7 per cent., 7.5 per cent. being nearer the figure. The greatest individual variations are seen in the fat, though the period variations in fat are not marked. The protein is highest in the colostrum period and falls to a little over half the proportion in mature milk, during which period it is seldom over 1.25 per cent. Of this, about one-third is casein and two-thirds lactalbumin.

The high ash of the colostrum period is due chiefly to the amount of $Na_2O$ and $K_2O$. Of the salts which make up the ash the greatest individual, as well as the greatest period, variations are seen in the $Na_2O$; the least individual and period variations are seen in the CaO, the proportion of which is nearly constant throughout the period of lactation. The largest constituent of the ash of woman's milk is $K_2O$, this with the CaO together make up more than one-half the total ash. Although in amount the total ash of cow's milk is about three and one-half times as great as that of woman's milk, the proportion of different

[1] American Journal of Diseases of Children, October, 1915.

salts which make up the ash is nearly the same, the only exception being that cow's milk has more $P_2O_5$ and less iron.

In an article upon breast feeding with some functional requirements, Waller[1] presents some interesting facts. He calls particular attention to the importance of paying regard to the periodic character of the breast secretion. To establish this the most essential measure is the regular stimulation of suckling with a sufficient interval between the meals. If this be observed the woman will be aware of a sensation which is variously described as a rushing, tearing, or painful stabbing in the breasts, known as the "draught," and experienced as soon as the child's mouth is applied to the nipple. In some the breasts can be observed to swell and become tense when a few moments before they were flaccid. There is in all probability a contractile muscular element in the occurrence, but there is also an undoubted secretory activity, for milk runs spontaneously from the nipple. In cases in which the periodicity is firmly established, the engorgement may even occur at the appointed time without the breast being stimulated by suckling. The flow lasts for a few minutes and then ceases. Waller emphasizes the need for corelation between the periodicity in the secretion of the milk, the size of the meals, and the infant's appetite. The breast tissue fulfils the physiological law that to obtain a maximum output of work a suitable stimulus must be applied at suitable intervals. The total quantity of milk secreted in twenty-four hours is greater when the number of meals given is six rather than nine or ten, and greater still when the six give place to five and four. This change to the smaller number can be made about the sixth or eight week. A child can take seven ounces of food from the breasts at one meal as early as the twenty-first day. If appetite can be considered as an expression of digestion, the author's observations show that large infrequent meals do not disagree with quite young infants. The cry of the overfed or of the too frequently fed is commonly mistaken for the cry of hunger.

The *influence of menstruation on breast milk* is studied by Grulee and Cauldwell.[2] In the case especially studied the mother's menstrual period began six weeks after birth and continued throughout the nursing. The quantity of milk was carefully measured, especially during the last four months of lactation, and there was shown a distinct relation between it and the occurrence of the menstrual period. This consisted in an increase of the quantity of breast milk beginning with the first day of menstruation and lasting from ten days to two weeks. There then occurred a diminution in the quantity which reached its lowest point four to seven days previous to menstruation, after which there was a gradual increase.

[1] Lancet, July 17, 1915.
[2] American Journal of Diseases of Children, May, 1915.

**Milk and Infant's Foods.** Some highly interesting investigations upon homogenized milk and its uses are reported by Maynard Ladd.[1] The homogenization of liquids of different densities consists in reducing the constituent elements into such a physical condition that they will no longer separate but will maintain a permanent and even composition throughout the mixture. Briefly stated this result is brought about by a powerful pump which forces the mixture through a finely ground agate valve against great pressure. After its passage the mixture is perfectly homogeneous, and in the case of milk, or mixtures of milk and oils, the fat globules are crushed, torn, and pulverized and so incorporated with the other elements that they can no longer separate after long standing or agglutinate. The mechanical device by which this result is made possible is the invention of M. A. Gaulin, of Paris. His first machine was brought out in 1899. Homogenization improves decidedly the taste of the milk or cream, particularly that of pasteurized milk. As the process prevents the separation of fat, homogenized cream can be readily pasteurized. The process of homogenization has a beneficial effect upon the keeping qualities of milk.

Ladd has carried on a series of experiments in order to show that vegetable oils, such as olive oil, are readily digested and assimilated when homogenized with skimmed milk in cases of intolerance to cow's milk fat. By using a chemically pure precipitated casein, one can combine pure casein with pure oils and pure sugars of different varieties, adding artificially prepared mineral matter in varying proportions. Such mixtures homogenized may be found to be of use in exact metabolism experiments, although they would be too expensive and complicated for practical feeding.

Homogenization of modified milks seems to increase their efficiency in cases in which there is no marked intolerance for cow's fat. There are other fats and oils which Ladd is planning to use as substitutes for cow's fat. Cod-liver oil, for instance, homogenized with fat-free milk or malt-soup mixtures, is fairly palatable as compared with ordinary methods of administration, but he has not yet tried it in a case of difficult fat digestion.

Studies upon the reaction of cow's milk modified for infant feeding are reported by Clark,[2] of Washington. His conclusion is that the addition of alkalies to modified milk for the purpose of reducing the high acidity of cow's milk is based on wrong principles. The addition of alkalies to cow's milk for the purpose of preventing firm clots in the infant's stomach is a procedure which may not only be unnecessary, but one which involves a possible inhibition of both gastric proteolysis and lipolysis. The addition of alkalies to modified milk is criticised because of its probable influence in displacing from the intestine a normal

[1] Boston Medical and Surgical Journal, May 1, 1915.
[2] Journal of Medical Research, January, 1915.

bacterial fermentation and replacing it with those proteolytic or putre-
factive processes which are responsible for so many of the digestive
disorders of infancy.

Some experience with Friedenthal milk are reported by Riesenfeld,[1]
of New York. This milk was intended to remedy the error that has so
commonly been made of neglecting the salts in artificial food. Frieden-
thal believes that greater attention should be devoted to the ash contents
of foods given to children during the first three years of life. His formula
is as follows: Skimmed milk, 330 c.c.; water, 660 c.c.; lactose, 68.9
gm.; molkerei salts, 1.89 gm.; fat (in cream) to 4.5 per cent. gm. The
molkerei salts are composed of potassium chloride, 2 parts; potassium
phosphate, 1 part; potassium biphosphate, 1 part. The caloric value of
this food is 770 c.c. As used by Riesenfeld, Friedenthal milk in its
original form showed results not encouraging. When lactose in the
mixture was replaced by cane-sugar or dextri-maltose, the gain in weight
became satisfactory. He believes that in Friedenthal's modification
of milk we have a food that can be administered throughout infancy
and without change except in the amount given. Of the 21 infants
placed upon it, 19 made a steady normal gain in weight; infants under
three months of age making the greatest progress. The infants who
failed to gain showed a marked intolerance for the high fat and sugar
content of Friedenthal's milk, and could only be given food containing
low quantities of sugar and fat.

After a considerable study of the effects of boiled milk, Dennett,[2] of
New York, concludes that the prolonged use of boiled milk, if properly
administered, does not necessarily cause nutritional disorders such as
rickets, anemia, malnutrition, or poor musculature. Scurvy may be
avoided by the administration of orange-juice. Boiled milk does not
cause digestive disturbances in normal infants, and is not more difficult
to digest than unboiled milk. It is probably more apt to cause con-
stipation than unboiled milk. The evidence is not conclusive whether
the value of the milk is lessened by boiling or not.

Poulsen[3] reports experiences with 124 infants fed on albumin milk.
His formula differs from that of Finkelstein, as he uses nine parts of
casein to eight parts of carbohydrate instead of two to one. He also
uses a larger proportion of whey. One liter of this food represents 560
calories instead of 420 in that of Finkelstein. The preparation, like
that of all albumin milk, is somewhat complicated.

A study of the preparation and composition of protein milk is reported
by Courtney and Fales,[4] of New York, from which they conclude that
the chief variation in the composition of protein milk is in the fat.

[1] Archives of Pediatrics, August, 1915.
[2] Journal of American Medical Association, December 5, 1915.
[3] Jahrbuch f. Kinderheilkunde, September, 1915.
[4] American Journal of Diseases of Children, September, 1915.

Uniformity is chiefly secured by the exercise of great care in handling the curd. Since the value of protein milk is in large measure due to its low sugar content, the washing of the curd with water is a useful means of removing an additional amount of sugar. When properly prepared the amount of protein is quite constant and is generally somewhat greater than that of the original milk. It is nearly all casein. The amount of phosphorus and calcium is somewhat greater; that of sodium, potassium, and chlorine is less than in whole milk.

# RHINOLOGY AND LARYNGOLOGY.

## By GEORGE B. WOOD, M.D.

THE European War, because of its vastness, producing countless numbers of sick and wounded and because of the employment of modern weapons and new methods of warfare, furnishes the medical profession an enormous field of observation and investigation along pathways which are seldom trod by medical students during times of peace. Frightfulness reaches its climax when the wound involves the face or throat. The large majority of these are, we were going to add fortunately, quickly fatal, as the surrounding vital structures are generally implicated in the trauma whenever the face or throat is injured by modern missiles; but the number of wounded is beyond human conception, so that even those cases become numerous which up to this time had rarely, if ever, been seen. The number of injured is so great when compared to the amount of medical and surgical aid that careful observation and specialization near the line of battle is impossible, and only when the wounded have been sent to the base hospitals can sufficient attention be paid to them to relegate wounds requiring attention of a specialist to the proper department. The services of the nose and throat specialists have been utilized both among the Allies and the Germans in taking care of wounds involving the nose and throat.

Gerber[1] reports his experiences with 647 cases which had been referred to his department. Among this number, numerous small operations were required, and in 20 cases large operations, such as the radical opening of the sinuses, were necessary. In his department there were from 150 to 200 cases examined and treated daily. He found that his cases could be classified under three groups: The first group includes those in which the missile had struck at a tangent or grazed the surface, and affects only the contour; such wounds as the ablation of the tip of the nose were included under this group. The second group includes perforating shots which were chiefly crosswise, from side to side; the missile passing through those parts happening to be in its line of travel, and interfering more or less with the functions of the organs, but only threatening life by complications arising during the healing process. The third group includes wounds accompanied by great destruction of tissue, with serious damage to the nose or larynx, and with absolute loss of function. These wounds usually threaten life because of the

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[1] Archives f. Laryngology und Rhinologie, 1915, xxix, Heft 3, p. 331.

damage to the surrounding structure, such as the eyes and brain, and in the case of the larynx because of accompanying lesions of the esophagus, large bloodvessels, or thyroid gland. In wounds involving the face, the sinuses are, of course, frequently opened, and although infections usually followed, a great many cases healed without any special reaction. In others, operations at a later period were necessary, and, at the operation, necrosis with sequestra formation was often found. In one case in which the entrance of the bullet was just above the eyebrow, there was extensive involvement of the sinuses, and at operation a large sequestra consisting of the anterior and inferior walls of the frontal sinus was removed. It was also found that the posterior wall of the frontal was completely absent, the dura being exposed and covered with granulations. The operator removed a portion of the lacrimal bone and the frontal process of the maxilla, and opened up the anterior ethmoidal cells. This patient recovered completely in about two weeks. In perforating wounds through the face and nose, which had healed spontaneously, it was frequently found that the track of the bullet could be traced by the presence of adhesions between the turbinal bodies and the septum. One of the most serious complications which occurred during healing was secondary hemorrhage, which at times was so severe as to threaten life. Destructive lesions of the larynx in Gerber's clinic were very rare, and this he believed was due to two facts: (1) the mobility of the organ probably let it escape from missiles that did not strike it directly, and (2) when the larynx was severely injured the rapid edema which followed the wound caused early death. He found that in many cases in which the wound was in the immediate neighborhood of the larynx, and the larynx itself uninjured, aphonia and hoarseness were frequently found while the vocal cords showed nothing pathological. In wounds of the neck almost any nerve involvement is possible, giving rise to various forms of paralysis. In one remarkable case which he reports, the entrance of the bullet was 2 cm. in front of the right ear and the exit was 2 cm. on the other side back of the left ear near the insertion of the sternocleidomastoid muscle. In this case the 7th, 9th, 10th, 11th and 12th nerves were all severed.

In regard to injury of the *pharynx*, R. Kafemann[1] has found that wounds involving the nasopharynx and the hypopharynx in themselves are not especially serious, but, of course, are frequently accompanied by involvement of the important surrounding structures. He believes that wounds of the nose, in spite of the severe comminutions of the bones, possess a high degree of recovering ability, and that the accessory sinuses seem extremely tolerant to the presence of foreign bodies. He reports a case of a bullet entering the forehead and lodging in the sphenoidal sinus, from which it was later removed.

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[1] Deutsche med. Wchnschr., April 22, 1915, p. 494.

Milligan and Westmacott[1] also call attention to the severity of wounds of the head, face and neck, the large majority proving immediately fatal. Yet, on the other hand, many of the injuries seen by them showed narrow escapes from death, the projectile having passed within a hair's breadth of some important structure. Compared with wounds of the other parts of the body, injuries of the head, face, and neck show a great immunity from septic complications, and in wounds of the face there was much less comminution of bone than when the bones of the extremities had been hit. In wounds of the larynx, edema was one of the most troublesome complications, and frequently tracheotomy had to be done. Gerber also calls attention to the danger of edema occurring five or six days after the injury.

Grundwald[2] reports a number of cases of injury to the accessory sinuses. He found one in which a shrapnel bullet had entered the eye and lodged in the sphenoidal sinus.

Closely allied with the injuries of the nose itself are those which involve the *mouth* and *jaws*, many of which were so disfiguring as to leave little resemblance to a human face. At the base hospitals, such as the American Ambulance in Paris, the coöperation of the dentist, the nose and throat specialist, and the general surgeon did much to alleviate the suffering and to restore the normal function of the parts. Some most remarkable results were obtained by skilful plastic work and the use of prosthetic apparatus, and this was true even in those cases where large segments of the jaw had been shot away and practically the whole of the lower face obliterated. Remaining jaw fragments were held in place by carefully made dental plates; metal arches and bone transplants were used to supply the missing fragments; plastic operations built up new chins and lips until finally these hideous deformities were converted into almost normal-looking faces.

At the American Ambulance in Paris the local treatment of the ulcerative and suppurative conditions following these severe trauma of the mouth consisted of little beyond mechanical cleansing. Daily douching with normal salt solution and the removal of splinters of bone, loosened sequestra, fragments of bullets, etc., was all that was done in the majority of cases, but excellent healing results were obtained. It was found that many of the stronger antiseptics caused sufficient irritation to seriously interfere with the vitality of the traumatized tissue.

**Anesthesia.** The choice of anesthesia for operations on the nose and throat is largely a matter of personal preference. A great many operators are using local anesthesia for the removal of tonsils, especially in adults. Ether is rightly the preferable anesthetic when general narcosis is desired, and is usually given by the open method, though many specialists use the nasal tubes or pharyngeal insufflation. In this latter method,

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[1] Journal of Laryngology, Rhinology, and Otology, August, 1915, xxx, 297.
[2] Müch. med. Wchnschr., June 15, 1915, p. 823.

however, it is essential that the vapor be warmed before introduction. Personally, I prefer the open method.

J. E. Lumbard[1] is enthusiastic for the use of ETHER OIL COLONIC ANESTHESIA for operations on the head and neck. His technic is as follows: The bowel, having been cleared by a compound licorice powder given the night before, is irrigated two hours before the operation with warm water until the return is clear. A large rectal tube is then inserted to be sure that the bowel is empty. Morphine and atropine are given a half-hour before the anesthesia is begun. For the introduction of the anesthetic a small well-oiled catheter is inserted about three inches into the rectum. The anesthetic mixture consists of three parts of ether and one part of olive oil by measure. This should be well shaken up in a bottle before using, and should be introduced very slowly, about five minutes being required for the complete dose. One fluidounce to twenty pounds of body weight is about the right proportion, but one should never use more than eight ounces of the mixture. The odor of ether is usually detected on the patient's breath in from three to five minutes after its introduction into the bowel, and anesthesia begins in from five to twenty minutes later. If the anesthesia is not complete, showing that the dose is too small, a few whiffs of nitrous oxide may be necessary. If the dose is too large, as manifested by sudden or deep anesthesia, the rectum should be immediately emptied. After the operation the rectum should be emptied, and, as soon as the patient has been returned to bed, the bowel should be irrigated with tepid water until the return does not show any ether oil. Three ounces of olive oil are then introduced and should be retained. This method of anesthesia is, of course, contra-indicated in diseased conditions of the bowel or for rectal operations. Lumbard says that he has never seen any rectal irritation following this method of anesthesia, and that the patient becomes anesthetized without any discomfort, and usually there is no postanesthetic excitement and seldom any nausea or vomiting.

The chief difficulty in rectal anesthesia is the uncertain control of the dose. It is well recognized that certain individuals require more ether than do others, and the danger of an overdose would seem to make rectal anesthesia distinctly less safe than the open method by inhalation, and its use should be limited, at least until further experience has shown us that it is safer than we can, *a priori*, believe.

## THE NOSE.

**Deformities of the Nose.** During the past year many cases of *operations for the relief of deformities of the external nose* have been reported, and in this connection it is interesting to note that William W. Carter[2]

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[1] Surgery, Gynecology and Obstetrics, May, 1915, xx, 553.
[2] Laryngoscope, June, 1915, xxv, 321.

has x-rayed a number of cases which have been operated on by himself and found that the transplanted bone which he used to support the nose had united in many instances, if not in all, with the local bony structures. In his latest cases he utilizes for the transplant a portion of the rib, having attached to it one-half inch of costal cartilage. The rib is split as it is removed and the periosteum is preserved on the excised portion. The advantage of the cartilage is that it gives flexibility to the tip of the nose. The method of operating is as follows: After sterilizing the nose and the surrounding area with iodine, the nasal cavity is blocked by pledgets of cotton. The tip of the nose is then raised with the left thumb and a small spatula-shaped knife is introduced from within the nostril at a point between the upper and lower lateral cartilages. By following the excursions of this knife with the thumb and the index-finger placed on the outside of the nose, the skin over the entire nose is elevated and a slit made through the periosteum over the nasofrontal process. After this extensive elevation of the tissues has been accomplished, the piece of rib, previously removed, is placed in its position with the cartilage pointing downward and anchored under the periosteum over the nasofrontal process. The end of the attached cartilage should reach within a half-inch of the tip of the nose. In 4 cases which Carter had operated upon by this method, the results were very satisfactory. He believes that if the bone is aseptically and autoplastically transplanted it continues to live and takes part in the local process of repair, in that it continues to grow, and its growth is limited by the physiological requirements of the part.

In cases of complete loss of the external nose, Fritz König[1] utilizes a transplant from the sternum which, with attached costal cartilages, makes a cross, the arms being used to support the nasal alæ. This transplant is first embedded in the tissue of the arm, from which tissue is taken for the skin of the new nose. He proceeds as follows: A cross-incision is made at the height of the fifth rib over the sternum to which is added in the median line another incision running downward 3 or 4 cm. and upward 6 or 7 cm. A strip of bone still covered with the periosteum is then separated from the surface of the sternum together with portions of the cartilage of both fifth ribs, which are left attached in the form of a cross. This transplant is immediately implanted under the skin of the left upper arm with the crossed arms toward the elbow and with the cut surface of the bone placed against the skin. The second operation, which occurs two or three weeks after the transplant has well healed in, consists in raising the flap, including the piece of bone and cartilage, until it is attached only at its lower end. This flap should correspond to the requirements of the new nose. The ends of the arms of the cross are approximated by a suture, causing the

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[1] Beitrage zur klin. Chir., 1914, xciv, Heft 3, 515.

lower attached end of the flap to resemble the peaked appearance of the nose. The inner raw surface of the flap is covered with Thiersch grafts and allowed to epidermatize. After this epidermatization has taken place, the edges of the nasal defects are freshened, as well as the edges of the flap, and the flap attached to its proper place over the nasal opening according to the ordinary rhinoplastic procedure. After the flap has become an integral part of the face, and receiving its nourishment from the surrounding structures of the face, it is detached at its lower end from the arm.

**Nasal Septum.** An interesting study of the DEVELOPMENT OF THE NASAL SEPTUM is that by W. W. Carter,[1] which was undertaken for the purpose of determining the etiology of certain cases of sunken deformity of the nose, due directly or indirectly to the submucous operation. As is well known, the septum has a most important function in the development of the nasal eminence, and Carter believes that this raising of the bridge of the nose is accomplished mainly by the vomer. The anterior border of the vomer is parallel with the projecting contour of the nose, and hence the growing vomer acts at right angles from the vertical plate of the ethmoid and septal cartilage, resisting the growth of the latter in a downward and backward direction. He says that ossification of the vomer does not occur in the cartilage but begins in two ossific centres situated in the lower back part of the membrane which covers the vomerine cartilage on each side. The fusion of these two lamellæ occurs behind and below at about the third month. This fusion gradually extends forward, absorbing and, to a certain extent, pushing forward the septal cartilage and the vertical plate of the ethmoid. This process continues until puberty, when the laminæ of the vomer have become completely united, and all that remains of the original cleft is the groove on its anterior surface, in which is lodged the septal cartilage. The method of closure of the vomerine cleft produces a force which, beginning posteriorly, gradually extends forward and continues during the years of actual nasal development, and shows conclusively the importance of the vomer in the developmental dynamics of the nose. Therefore extensive removal of the septum cannot be done with safety during the years of active nasal development. Carter regards fourteen years of age as the limit of safety. After the nose has reached its limit of development the submucous resection of the septum may be properly carried out, because at that time no injury, from the esthetic point of view, can be done and the architectural strength of the nasal arch remains unimpaired. He, however, believes that it is absolutely essential that the extreme anterior edge of the septum should be left in place.

Tydings[2] has devised a submucous septal operation in which the

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[1] Annals of Otology, Rhinology, and Laryngology, December, 1914, xxiii, 779.
[2] Laryngoscope, December, 1914, xxiv, 977.

cartilage and the bone of the septum are not removed, but its shape and position corrected and then left *in situ*. After elevation of the mucoperichondrium and the periosteum, as far as necessitated by the character of the deflection, the cartilage is loosened by severing all adhesions and bands, and is then pushed over into the groove along the maxillary crest upon the opposite side. If there is any marked redundancy of cartilage, a partial resection should be done. If the bone is involved it is made mobile by the use of the chisel and the structures placed in a perpendicular position. After restoring the mucoperichondrium and periosteal flaps to their proper position, the septum is kept in place either with splints or with a septal pin.

It is generally easier to remove deformed bone than to straighten it, and this is especially true of the cartilage. The resection of the deformed tissue is to be preferred to the simple correction of the deformity, as there is no reason or advantage in leaving the greater part of the cartilage and bone in place, and the lumen of the nasal chambers is increased by its removal. In cases of excessive roominess of the nasal fossæ, Tyding's operation might be valuable.

**Nasal Fossæ.** Finder, associated with Lydia Rabinowitch,[1] have published some rather surprising results concerning the IMPORTANCE OF NASAL BREATHING on the general health. Their experiments related to the influence which the nasal respiration might bear to the prevention of infection of the lungs; that is, does infection of the lung take place more easily with closed nasal breathing or with open nasal breathing? They experimented first with the B. prodigiosus and B. pyocyaneus and later with the B. tuberculosis. The surprising result was that their experiments with the tubercle B. seemed to indicate that an inhalation tuberculosis takes place more easily when the nose is free than when the nasal breathing is suspended.

These results seem very difficult of explanation, as we have been lead to believe, from our clinical observations as well as from experimental evidence, that the nose always acted as a distinct filter for the inspired air. Personally, I would prefer waiting for further evidence before sewing up the nostrils of the human race as a prevention against tuberculosis.

An interesting physiological study of THE EFFECTS OF THE ATMOSPHERE ON THE MUCOUS MEMBRANE OF THE UPPER RESPIRATORY TRACT has been published by G. H. Cocks.[2] This elaborate work was conducted under the auspices of the New York State Commission on ventilation. The writer had the use of two rooms, specially constructed, fitted with tiled walls, machinery for controlling the atmospheric conditions, such as fans, air washers, heating stacks, steam lines and ducts, and various instruments for registering the temperature and humidity. The

[1] Berliner klin. Wchnschr., November 16, 1914, p. 1809.
[2] Laryngoscope, September, 1915, xxv, 603.

reaction of the nasal mucosa to the atmosphere was determined by inspection of the nose by the use of the Glatzel moisture plate. It is impossible here to go into the enormous detail of his experimental work, which consisted of the examination of the nasal mucosa of some 478 persons, besides the observations of the changes in the larynx and trachea of dogs which were subjected to peripheral stimulation by means of heat and cold. We quote his summary and conclusions:

"Our clinical experiments demonstrate that distinct changes in the mucous membrane of the nose result from changes of air temperature and humidity. In the majority of instances the reaction is one of increased swelling, moisture and redness from heat, and the reverse from cold.

"The effect of air blown directly upon the face by means of fans greatly modifies the changes observed. On going from the cold to the hot rooms with fans there is a decrease in the size of the inferior turbinate and in the amount of moisture. The characteristic change on passing from the hot to the cold condition with fans is an increase in the turbinates and secretion.

"It was further observed that moist heat produces greater changes than dry heat, while the highest percentage of cases of atrophic rhinitis was found among long-time workers in hot moist rooms (steam laundries).

"The window and foot-bath experiments tend to show that the reaction of the nasal structures to atmospheric changes is primarily direct and local, and not reflex, although the evidence on this point is inconclusive.

"It must be remembered that turbinate reactions are very delicate and that the changes that we have observed are by no means constant. It would appear, however, that the reactions in the nasal mucous membranes produced by changes in atmospheric environment are too frequent and too definite to be disregarded. Consequently we are convinced that the theory of bacterial infection as the sole cause of catarrhal inflammations of the upper air passages is not tenable, since the changes produced by environment must materially affect the incidence of infection."

While it has been recognized for some time that the nasal mucosa reacts to various atmospheric conditions, it is interesting to have these changes established on a scientific basis; yet we cannot get away from the clinical facts that the ordinary acute catarrhal inflammation of the upper air passages are infectious and the lesions present are the result of irritation from bacterial products. It is possible, however, as Cocks states, that the changes produced by environment in the mucosa of the upper respiratory tract must materially affect the incident of infection. Here, however, we come upon a very complicated question, depending for its solution upon the importance of such biological phe-

nomena as immunity, the individual's general resistance, the anatomy of the nose itself, and the dosage and variety of the infecting organism.

It comes back to the simple fact that when the strength of the organism is sufficient to overthrow the resistance of the individual, infection takes place. When once established we must remember that colds are infectious diseases and extremely contagious, and, without the presence of microörganisms, changes in the nasal mucous membrane resulting from atmospheric conditions cannot produce an ordinary acute rhinitis.

Concerning the ETIOLOGICAL IMPORTANCE OF THE VARIOUS BACTERIA IN THE PRODUCTION OF ACUTE AND CHRONIC RHINITIS there seems to be considerable evidence accumulating as to the specific nature of the Bacillus rhinitis. Tunicliff[1] has found that this organism is present in almost every case of acute and chronic rhinitis, and almost always absent from the normal nose. Experimentally, rhinitis could be produced with it, and the organisms recovered in pure culture from the nose of the experimental animal. Patients suffering from acute and chronic rhinitis and persons injected with the bacillus show the presence of specific antibodies, such as opsonins and complement-binding bodies.

Howell,[2] using the Bacillus rhinitis as an antigen, was able to obtain fixation of the complement with the serums of persons with rhinitis and also of persons injected with the bacillus after it had been killed by heat. This fixation he found most marked a few days after the onset of the infection, but that it lasted only a short time. He also found that the serums of normal persons, and of patients suffering with other infectious diseases, do not give the complement-fixation with the Bacillus rhinitis, and, further, that serums of patients with acute rhinitis rarely gave fixation of the complement when organisms frequently supposed to be the etiological factor in the production of rhinitis, such as the pneumococci, staphylococci, streptococci, influenza bacillus, fusiform, pseudodiphtheritic bacilli, etc., were used as antigens. He believes, therefore, that he is justified in saying that the Bacillus rhinitis bears a specific relationship to acute rhinitis as found in his neighborhood.

It was quite a number of years ago that Perez, of Brazil, made the announcement that ATROPHIC RHINITIS was due solely to a small coccobacillus which he had been able to isolate from the nasal secretion. Hofer, of Vienna, took up this work seriously and confirmed almost all of the statements of Perez, and became an enthusiast in the belief that atrophic rhinitis was a specific disease, due to the cocco-bacillus fetidus of Perez. Hofer, associated with Kofler, has gone further, and endeavored to produce a vaccine which would have a specific effect on atrophic rhinitis. Henry Horn,[3] who has been over and watched

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[1] Journal of Infectious Diseases, May, 1915, xvi.

[2] Ibid., No. 3.

[3] Journal of American Medical Association, August 28, 1915, p. 788.

the work of Hofer, in Vienna, published a series of experiments which he has himself carried out in America. His results, from a small series of experiments on rabbits, confirms the work of Hofer insofar that the cocco-bacillus when injected into the rabbit produces disease in the nose, from the pus of which the organism can be recovered. If the doses were large enough the animal died in from twelve to twenty-four hours, yet even then there was some evidence of some selective action by the organism on the mucous membrane of the turbinate bones of the nose. Smaller doses caused intense congestion of the nasal mucosa, and if this process were allowed to continue, pus formed in and about the turbinate bone, finally blocking up the nares, and in some of the rabbits which withstood large doses for a comparatively long time, marked atrophy of the turbinates was noticed. The proper method of taking culture from the nose in a case of ozena, Horn gives as follows: The crust is taken from the nose, preferably from the anterior end of the middle turbinate. This is dropped into a bouillon tube and incubated for exactly twelve hours. This period of incubation is a very important point, for it has been found that a lesser period does not give the organisms time to grow, and the incubation of over twelve hours causes such an overgrowth of accompanying organisms that isolation of the Perez bacillus is impossible.

At the end of twelve hours a drop from this bouillon tube is spread over from three to five agar Petri dishes. These are incubated for twenty-four hours and then separate colonies are transferred to agar slants. In fishing for the colonies a great deal of experience and judgment is necessary, those conforming to the characteristics of the staphylococcus, Micrococcus catarrhalis, streptococcus, Bacillus proteus, and other well-known forms are not transferred. While the colonies of the Perez bacillus are usually small, moist, and transparent, there is nothing absolutely characteristic of them.

After twenty-four hours on agar slants the characteristic odor is usually developed, and by this odor the organism can be fairly well identified. There is also nothing characteristic of the slant growth, the pure culture looking much like the ordinary staphylococci. The presence of a marked odor is very variable. It is not so strong as observed in ozena in the patient, but, while mild, is quite characteristic.

Although Horn has not been able to obtain agglutination, even when he has followed exactly the technic of Hofer, he believes that the Perez vaccine is of great value in the treatment of ozena. Concerning the dosage the clinical manifestations are the best guide, and a period of at least one week should intervene between the injections. The dose varies with every vaccine and every patient. An initial dose of 50,000,000, doubling until the proper constitutional symptoms develop, is about correct. The general reaction consists of a rise in temperature, loss of weight, malaise, and vomiting. The local reaction is redness and

swelling around the injection and swelling of the adjacent gland, while the focal symptoms consist of coryza, free discharge from the nose, a sensation of heat and fulness over the bridge. It is these later symptoms that we should endeavor to produce if the full effect of the vaccine is desired. From five to fifteen injections are considered necessary for a complete cure, and the patient must be carefully watched for a relapse, when treatment again should be instituted. From his work he concludes that the isolation of this organism is attended with much difficulty; that the preparation of an autogenous vaccine in some cases is very difficult, if not impossible; that the use of mixed vaccines made from several strains of the Perez bacillus is the most practical method of treatment now available. Further, he says that it may be necessary to precede or combine the treatment with vaccines made from other organisms usually present in atrophic rhinitis, and he considers it not improbable there are two or more types of ozena bacteriologically different, though clinically identical.

On the other hand, Murray and Larson[1] have not been able, either by experiments or clinical study, to substantiate the claims of Perez and Hofer that the cocco-bacillus, as described by them, is the specific agent of chronic atrophic rhinitis. A summary of their experimental work is as follows:

"In experimental work 27 rabbits were injected with cultures of Perez bacilli received from Hofer. We were unable to confirm the work of Perez and Hofer in which they state that their bacilli shows a selective affinity for the nasal mucosa. We did succeed in isolating the organism from the nasal passages of 4 rabbits, but it must be emphasized that we never succeeded in isolating the organism from the nose save in those cases in which it was also present in the heart's blood. In none of the 27 animals used in our experiments was there any evidence of atrophy of the turbinate bodies. Twenty-four ozena patients were examined bacteriologically, according to the method recommended by the Vienna author; all gave negative results. Agglutination tests were made from the blood of 34 ozena patients, but no frank agglutination reactions were recorded. The complement-fixation reactions were likewise negative in the 6 cases examined."

Clinically, however, in a proportion of cases some improvement was obtained by the use of the vaccine both subjectively and objectively. In 2 cases there was undoubted objective improvement in the crust formation, and in a large number there was subjective improvement in the fetor and pharyngitis sicca. Murray and Larson say, however, that while the clinical results had been encouraging in some of their cases, they do not believe that their clinical evidence is sufficient to warrant the belief that the Perez bacillus is the true cause of ozena.

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[1] Laryngoscope, November, 1915, xxv, 763.

The unanimity of opinion of those who had previously worked with the Perez bacillus was exceedingly encouraging, so that this article of Murray and Larson's, while apparently a wet blanket to dampen our enthusiasm, ought really to stimulate further investigation in this important matter.

Concerning the PATHOLOGY OF THE NASAL FOSSÆ, Joseph C. Beck[1] supplements his work of a year ago by a publication of his more recent histological investigations of conditions found within the nose. He has noticed that in septal ridges the bone shows a rarefication similar to that which he has previously found in the middle turbinal body and ethmoid cells in cases of hyperplastic ethmoiditis and atrophic rhinitis. Again, he believes that this change is due to a disturbance of the function of the glands of internal secretion. In ordinary cases of hypertrophic rhinitis, Beck has seldom found any bone changes, the hypertrophy being almost solely in the soft tissues and involving either the mucous glands, the bloodvessels, the connective tissue, or the epithelium, sometimes separately, but usually in some combination. The most common form of hypertrophy shows the connective tissue predominating, and, on account of the cicatricial contraction, there is usually associated some destruction of the glands and vessels. When the epithelium is continually irritated, as in cases of accessory sinus suppuration, it becomes very much hypertrophied and is at times a'most papillomatous. In atrophic rhinitis, the interference with the function of the mucous glands is due to a distention of the gland itself rather than to contraction of the surrounding connective tissue. He believes that the best method of treating hypertrophy of the inferior turbinate is by the crushing method, and histological studies made after the operation show that very satisfactory results can be obtained by this procedure. The membranous deposit which follows operative procedures in the nose is characterized by the scarcity of bacteria within its substance and by the predominance of polymorphonuclear cells over round cells.

HAY FEVER. There has been of late a great deal of interest centred around the possibilities of treating hay fever by *active immunization*, using for this purpose extracts of the pollen of various plants which have been shown to be the irritating factor in the production of both the early and late forms of hay fever. There seems to be little doubt among the various investigators that hay fever must be considered as an anaphylactic condition.

Robert A. Cook[2] believes that hay fever is an anaphylactic condition, and that the capacity for sensitization is probably inherited, although the type of sensitization is individually acquired.

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[1] Annals of Otology, Rhinology, and Laryngology, December, 1914, xxiii 790.
[2] Laryngoscope, February, 1915, xxv, 108.

Seymour Oppenheimer and Mark Gottleib[1] believe that the protein of the toxin gains access to the individual through the respiratory tract, where an abrasion of the mucous membrane makes a parenteral absorption possible. They have seen typical symptoms of anaphylaxis produced in a patient resulting from an excessive dose of the pollen extract.

Henry Iskowitz[2] states that sometime during life a parenteral absorption of a foreign protein from the pollen takes place, and from this a specific antibody is formed. This antibody may become attached to certain cells or remain free. If there is a surplus of free antibody, immunity is established, but when there is only a small amount of antibody and this amount is attached to the cells then the sensitized state is produced. The latter condition is that found in hay-fever patients, and the purpose of the active immunization is to raise the amount of free antibody.

E. T. Manning[3] has shown that guinea-pigs can be sensitized to pollen protein by minute doses gradually increased, when, after a suitable incubation period, they will suffer a most severe anaphylactic shock on reinjection. Also, guinea-pigs injected with the serum from the blood of patients suffering from autumnal catarrh and later reinjected with a solution of 1 to 10,000 rag-weed pollen developed a typical anaphylactic reaction, thus proving that the guinea-pigs can be sensitized to pollen proteins by a hay-fever patient's serum. Manning says that the best explanation of the action of pollen in hay fever is that given by Koessler, who believes that the sensitization results from a disturbance of the power of the nasal secretion to break up complex protein molecules, and that, owing to this deficiency, there occurs a parenteral intake of foreign protein.

It does not seem probable that the sensitization takes place as suggested by some, through cuts and abrasions of the skin, and happily so, for, as suggested by Goodale,[4] there would certainly be considerable risk in the employment of skin-reaction tests, as we should thereby run the risk of individual sensitization. Goodale has gone over this point very carefully, testing many patients repeatedly with pollen to which they were originally negative, and he has not in any case been able to discover the subsequent development of a sensitization. He did, however, have two incidences of distinct, but harmless, anaphylactic shock following injection of the pollen toxin for immunization in persons already suffering from hay fever. In this publication, Goodale reports the results of observations based upon 123 cases of hay fever examined during the preceding twelve months, which were made for the purpose

[1] Bulletin of Medical and Chirurgical Faculty of Maryland, July, 1915, viii, 3.

[2] The Medical Record, August 14, 1915, p. 270.

[3] Journal American Medical Association, February 20, 1915, p. 655.

[4] Boston Medical and Surgical Journal, July 8, 1915, p. 42.

of determining, if possible, the value of subcutaneous injection of pollen extracts and also to ascertain what biological relation, if any exists, between the pollen of different plants. Without going into detail, it may be sufficient to state that Goodale believes that he has shown by serobiological methods that the occurrence of the reactions of the various pollens demonstrate the existence of certain phylogenetic relations corresponding to the different plant orders and families. The application of these discoveries to the treatment of hay fever by the injection of plant proteins promises to assist in the selection of the specific material required for a given case. He believes that sensitization from the compositæ represents, in America, the most important form of hay fever. In his conclusions, Goodale says that definite reactions are elicited in hay fever by the pollen of the exciting plants when brought into contact with an abrasion of the skin. The intensity of these skin manifestations may be sensibly diminished by the repeated parenteral administration of the proteins in question. Coincident with the diminution in the skin reactions, there seems to occur an increased tolerance of the exposed membrane to the pollens of the plants employed. Pollen therapy in hay fever may be regarded at the present time as a promising method of treatment, but its value and the permanence of its result remains still to be definitely established. The results so far obtained by various observers, while very encouraging and promising, are not absolutely conclusive. Manning says that he has a very distinct impression, from his work, that the injections have been of decided value in ameliorating the distressing symptoms, but that much of the success of the treatment depends upon the judgment exercised to meet the particular symptoms of each individual case, and that the treatment cannot be rigidly applied in the same way to all cases. He believes also that harm may result from the treatment unless certain precautions are taken, namely, the solutions must be sterile and also fresh, and, as far as humanly possible, of uniform potency. Oppenheimer and Gottleib call attention to the fact that to treat patients successfully it is necessary to determine the reaction of the patient to the specific plant, which, of course, is done by the skin test. They also, by comparing the wheals produced before and after treatment, determine the time for discontinuance of the treatment. Also, they believe that while the immunity produced by active immunization may not be successfully carried over to the succeeding years, the attacks are much milder and the patient requires much less immunization. Out of 11 cases treated in 1914, there were 5 cured, 4 had very mild symptoms, and 2 were not improved.

Iskowitz says that some of the patients will carry their immunity over to the ensuing year, though others may have attacks which are milder and last a shorter time. However, for a permanent cure it is important that patients be treated for several years.

Cook reports 60 cases treated during the past year. There was marked improvement in 60.5 per cent., some improvement in 31 per cent., and no improvement in 8.5 per cent. These were the early cases. Of the autumnal type, 80 cases were treated, with marked improvement in 25 per cent., slight improvement in 50 per cent., and no improvement in 25 per cent. He believed that the difficulty in obtaining good results with the late type of hay fever was due to the fact that the pollen is present in the air in much larger quantities, and has a somewhat higher degree of toxicity, requiring a much higher degree of immunity. He also warns against the unguarded use of this form of treatment, especially in the highly sensitized individuals, as an overdose may give rise to most distressing symptoms and could conceivably induce death by anaphylactic shock.

Another method of treating hay fever, which Emmerick and Loew[1] claim is very useful, is the use of *calcium chloride*. The action of calcium chloride depends upon the fact that the cell nuclei in glands, muscles, ganglion cells, and leukocytes require calcium for its proper functioning, and food is also more completely utilized when calcium is being taken, which is probably due to an increased production of enzymes. The calcium also probably increases phagocytosis, strengthens the constitution and increases the resisting powers, besides acting as a nerve sedative. Hay fever patients should also consume relatively large amounts of vegetables and fruit, as the potassium salts help to maintain the alkalinity of the blood, which, in turn, aids in the retention of the calcium. They prescribe 100 grams of crystallized calcium chloride dissolved in half a liter of distilled water. Three teaspoonfuls of this are taken during the day, always with the meal, and this amount of calcium chloride can be taken practically indefinitely without harm. The treatment should begin five or six months before the expected attack. He says that the cures brought about by the calcium chloride treatment seem to be permanent.

Kellog[2] uses *sodium bicarbonate*. From his experience, he declares that the nasal mucosa becomes hypersensitive on account of certain irritating qualities of the blood. The dose used was 1 dram three times a day. Out of 50 cases treated during three years, 90 per cent. enjoyed a marked amelioration of the symptoms, with 70 per cent. of complete relief after a few days' treatment. Only 10 per cent. showed no improvement. In some cases he found it necessary to use, in addition to the internal medication, a nasal spray of sodium bicarbonate solution.

Karl Schmidt[3] obtained excellent results in 2 cases of hay fever with the use of the *x*-rays. He recommends two exposures at fourteen-day intervals, using a ⅓ erythema dose, according to Sabouraud-Noire.

[1] Münch. med. Wchnschr., January 12, 1915, lxii.
[2] New York Medical Journal, August 21, 1915.
[3] Münch. med. Wchnschr., June 8, 1915, p. 773.

He believes, however, that it may be occasionally necessary to use a third exposure in order to be sure of a lasting result.

P. J. Mink[1] calls attention to the *pathology* and *therapy of the spheno-ethmoidal recess.* In this paper he treats only of the catarrhal processes found in this part of the nose. Mink claims that the spheno-ethmoidal recess plays the same role to the posterior group of the accessory sinuses as the hiatus semilunaris does to the anterior group. Acute inflammation of the nose, because of the swelling of the middle turbinal, prevents drainage from the sinuses in the posterior and upper part of the nasal chamber, except in a backward direction downward through the spheno-ethmoidal region. The upper part of the nose is the last portion of it to yield during recovery from acute catarrhal conditions, and, because of the comparatively small amount of secretion in this region, there is a distinct tendency for the accumulation of thick, mucopurulent material in the spheno-ethmoidal recess. The anatomical relation of the mucous membrane of this recess to the sphenopalatine ganglion is such that involvement of the ganglion may readily follow disease of the mucous membrane of this recess; and, further, Mink believes that the round-cell infiltration, which results from inflammatory conditions of the mucosa, may possibly cause an excess of fibrous tissue which distinctly interferes with the function of the nerve branches given off from the sphenopalatine ganglion. Because of this interference, various alterations of the circulation, atrophic changes in the mucosa, and disturbances of the secretory processes may result and give rise to catarrhal processes throughout the whole extent of the nasal fossæ.

In the *treatment* of the disease of the spheno-ethmoidal recess, it must be remembered that in acute rhinitis the upper part of the nose is difficult to reach with sprays or vapors, because of the swelling of the middle turbinal which blocks off the olfactory region. For the purpose of passing this barrier, Mink uses a small rubber Eustachian catheter which he passes up beyond the middle turbinal. The application of pigments to this region can be accomplished either by the use of a very thin applicator or by bending the end of the applicator almost at a right angle, when it can be passed up posteriorally to the middle turbinal. The point of the applicator, after being passed upward, can be rotated outward and made to sweep downward through the recess. This procedure cleanses the mucosa and frequently brings out a mass of mucous, thick purulent secretion, or even crusts. It is also important that the middle turbinal be kept as small as possible, and, for this, Mink uses trichloracetic acid or chromic acid, but advises strongly against the application of the galvanocautery in this neighborhood.

Since Sluder's publication concerning the *injection of the spheno-palatine ganglion,* numerous other publications have appeared during

[1] Archives f. Laryngologie, etc., 1915, xxix, Heft 2, p. 165.

the past two or three years relative to its usefulness and dangers. H. L. Pollock[1] injects the sphenopalatine ganglion for four general conditions: (1) hay fever; (2) sphenopalatine neuralgia; (3) hyperesthetic rhinitis; and (4) postoperative neuralgia. His results with hyperesthetic rhinitis have been very good, although in hay fever not sufficiently so to warrant any definite conclusion. In neuralgia they have been very satisfactory. If he does not succeed in obtaining favorable results by the first injection, he uses a second, third, and sometimes a fourth. If, however, after the fourth no relief is obtained, he does not feel warranted in carrying them any further, as he believes the case will not yield to this form of treatment.

M. A. Bliss,[2] in discussing his later experiments with the injection of the sphenopalatine ganglion, says that the result of the injection could not be considered complete for at least three months after the injection. He has noticed that this is especially true since carbolic acid has been added to the alcohol. If, at the end of that time, the result is not satisfactory, he reinjects. It is probable that the instillation of alcohol in the immediate neighborhood of the ganglion in most cases is fairly efficacious, but does not give such positive results as when the ganglion itself is caught by the injecting fluid. It is for this reason that the second injection, and possibly a third, is sometimes necessary.

The indiscriminate use of the injections of the sphenopalatine ganglion is to be deplored, as the procedure is not without danger, and, even in the hands of the most experienced specialists, serious complications sometimes arise. For the treatment of such minor conditions as hay fever and hyperesthetic rhinitis, I believe that the sphenopalatine injection is absolutely unjustifiable. In cases of severe neuralgia, when the condition is almost intolerable, certain risks have to be taken.

There have been several *intranasal methods* suggested *for obtaining drainage for the lacrimal sac* into the nose, but the majority of these operations have either been to simply puncture directly into the nasal fossa, with or without the formation of a mucosal flap, or, after removal of the anterior end of the inferior turbinal, to attempt to restore the canal along its normal position. Mosher[3] has devised an operation for drainage of the lacrimal sac and nasal duct into the unciform fossa. The essential steps of the operation are the uncovering of the unciform fossa by the removal of the anterior end of the middle turbinate, the dissection of a mucous membrane and periosteal flap from the fossa, the breaking down of the inner wall of the unciform cell, the slitting of the inner wall of the nasal duct and lacrimal sac, and the widening of the nasal duct itself by removing the lip of the ascending process of the superior maxilla. The danger-point in the operation is the possi-

[1] Illinois Medical Journal, 1915, xxvii, 277.

[2] American Journal of the Medical Sciences, 1915, cxlix, N. S., 230.

[3] Laryngoscope, November, 1915, p. 739.

bility of opening the unciform groove, and thus establishing an accessory ostium into the antrum which, from its position, would carry infection from the lacrimal sac into the cavity of the sinus. The first incision for raising the flap is made with an appropriate knife along the posterior edge of the ascending process of the superior maxilla, beginning at least as high as the level of the anterior attachment of the middle turbinate and carried downward to the upper border of the inferior turbinate. From the bottom of the vertical incision a horizontal one is made along the upper rim of the inferior turbinate for about half an inch. From the top of the vertical incision a second horizontal incision is carried backward across the upper limit of the unciform fossa and over the inner face of the extreme upper part of the unciform process. After the flap is elevated, which sometimes is easy and again almost impossible, it is pushed backward and downward, so as to expose as much as possible of the unciform fossa. The author's stiff probe is introduced into the nasal duct from the inner canthus and carried down into the inferior meatus. The inner wall of the lacrimal cell is opened with a curet, which is directed forward against the posterior border of the ascending process of the superior maxilla, care being taken not to remove the unciform process. The probe in the duct is now gradually withdrawn while pressure is being made inward with its point, so that, as soon as the point escapes from the upper rim of the inferior turbinate it breaks through the inner wall of the nasal duct into the unciform fossa. The point of the probe is now advanced a little into the cavity of the nose and then swung strongly upward, which tears open the inner wall of the nasal duct from the inferior turbinate to the lacrimal sac. While the probe is still in place, the whole length or the posterior surface of the ascending process of the superior maxilla is curetted away with a small curet, the bowl of which is at a right angle with the shaft. The flap is replaced and held in position with a small piece of gauze fastened to a ligature which passes outward through the inner canthus of the eye. Although this operation, like others of its kind, faces the danger of cicatricial closure of the canal, Mosher believes that it gives a much larger opening into the lacrimal sac than does any other procedure.

F. H. Hanger[1] somewhat simplifies the intranasal operation for the cure of dacryocystitis. He cocainizes the sac by injecting a few drops of a 20 per cent. solution with adrenalin chloride (1 to 1000), while the upper part of the nasal duct is anesthetized with cocain applied by a small applicator passed through one of the canaliculi. Progressively larger probes are then passed through the inner canthus until a Theobold No. 13 can be pushed down into the inferior meatus. This probe is left *in situ*, and is the guide for the operation within the nose. After cocainization of the interior of the nose, the front part of the inferior

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[1] Laryngoscope, January, 1915, p. 23.

turbinate is removed until the lower end of the probe can be seen in the inferior meatus. .The lower part of the bony nasal canal can be cut away with a gouge or curved chisel and the inner wall of the nasal duct removed by right-angled punch forceps, which follows up the gradually withdrawn lacrimal probe. The duct is thus converted into an open gutter and the operation is finished.

Recently, emetin has been used for the purpose of controlling hemorrhage, especially that following operations upon the nose and throat. Weinstein[1] has used it in 12 cases during and after operations on the nose and throat with great success. It is employed both for the purpose of controlling and of preventing hemorrhage. The dose is one-half grain of emetin hydrochloride given hypodermically.
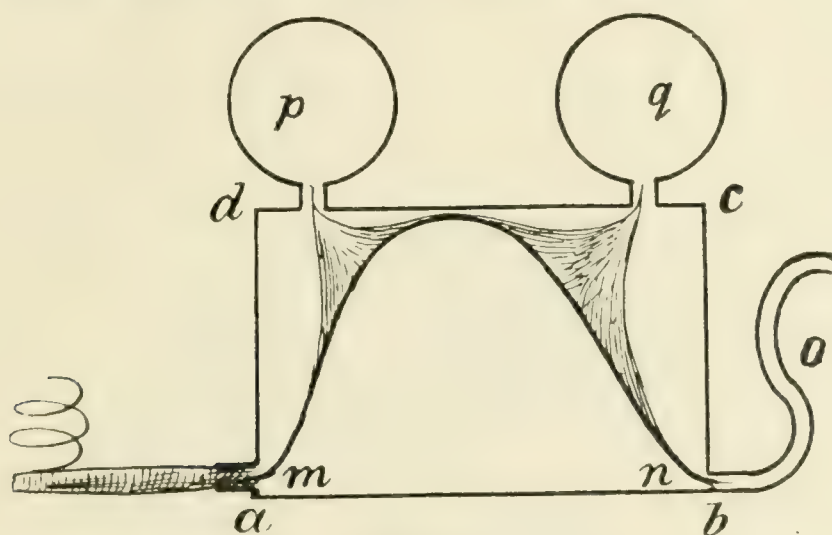


FIG. 16

**Accessory Sinuses.** The physiology of the accessory sinuses, if indeed they have any purposeful existence, is very obscure. Many theories have been advanced. Some believe they act as resonators for the voice, but the majority opinion is that they exist only as the result of nature's attempt to lighten the weight of the skeletal structures of the head. P. J. Mink[2] advances a rather ingenious theory for the function of these structures. His belief is that the accessory sinuses tend to cause a diffusion of the air stream as it passes through the nose during inspiration, and that this diffusion produces a more extensive stimulation of the nasal mucosa necessary for certain physiological reflexes important to the respiratory phenomena. To explain the method whereby the accessory sinuses cause this diffusion, he has constructed a small box, one side of which is glass for observation, and which has an entrance hole on the two extremities close to the bottom. On the top of the box there are two small chambers communicating with the interior by two small openings (Fig. 16). At *a* a cigar is inserted into one

[1] Medical Record New York, January 16, 1915, lxxxvii.

[2] Archiv f. Laryngologie und Rhinologie, 1915, xxix, Heft 3, p. 153.

of the openings, and at the other opening is attached a rubber tube through which suction is made. It can be seen that the smoke stream passes upward as represented by line *m-n*. The two chambers *p* and *q* represent the accessory sinuses. Suction on the respiratory tube, of course, produces a partial vacuum inside the box, and also in the accessory chambers. When this suction is relaxed it will be noticed that the smoke stream is partially deflected from its previous route and a small portion enters into the opening of each accessory chamber, as represented by the shading in the diagram. This diversion is due to the restoration of the normal pressure in chambers *p* and *q*. In a schematic representation of the nasal cavity (Fig. 17) the normal air stream is represented by a dark line and the
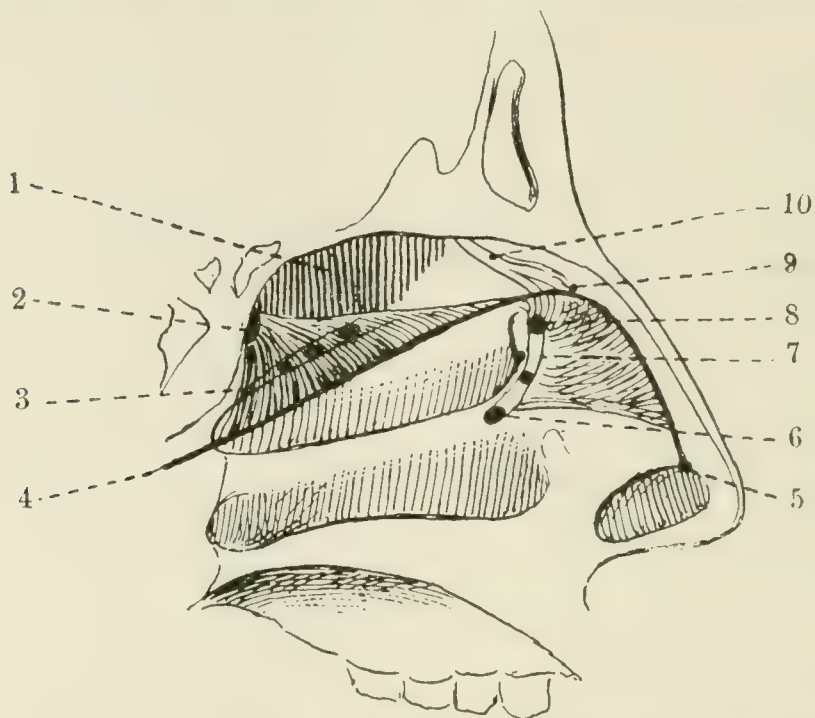
FIG. 17.—*1*, olfactory region; *2*, opening of the sphenoidal sinus; *3*, superior meatus with openings of the posterior ethmoidal cells; *4, 5*, line of air stream; *6*, opening of the maxillary sinus; *7*, hiatus semilunaris; *8*, opening of the frontal sinus; *9*, line of stream of the inspired air; *10*, nasal nerve.

diffusion by radiating shaded lines. As shown, the sphenoidal sinuses and the posterior ethmoidal cells act together as a unit, and tend to divert the stream upward. The olfactory region, the frontal sinuses, and the anterior ethmoidal cells, as well as the maxillary antrum, act as a unit and tend to divert the normal stream downward and backward, passing over the area supplied by the nasal nerve. The function of this diversion of the stream by the posterior group of cells is easily understood, as it permits the inspired air to reach the olfactory region; but the function of the diversion caused by the anterior group of cells is more difficult to understand. Mink says that this diversion increases the area of surface, which can be stimulated by the inspired air, which stimulation is important in that it produces a greater reflex action

necessary for certain respiratory phenomena. It is well known that if the region reached by the inspiratory stream is stimulated with a cotton pledget, an increased respiratory movement is produced, and that if this stimulation is kept up, sneezing or coughing follows. Similarly, if an individual passes into a different atmosphere, such as may be found in a hothouse, there is at first a deep inspiratory effort which disappears as the person becomes accustomed to the change. The stimulus necessary for this respiratory movement is due to the influence of the air stream on the nasal mucosa, hence the importance of the accessory sinuses in extending the area of this influence.

Disease of the accessory sinuses occurring in young children is rather rare, though it is very possible that many cases remain undetected even after careful examination. Onodi,[1] however, reports 53 cases. In 23 the disease of the accessory sinuses occurred as a complication of scarlet fever. He found disease of the maxillary sinus in 8 cases at birth and in 2 children twenty-six days old, and another case of an infant, eighteen days old, which showed ethmoidal sinusitis.

There is no doubt that sinusitis does occur in young children, but almost always as a complication of one of the infectious diseases, and under these circumstances it may easily go unrecognized. Probably, in the large majority of cases, the seriousness of the general infection overshadows the minor complication in the nose, and it is only recognized when there is necrosis of the bone followed by rupture either internally into the cranium or externally into the eye.

Herbert Tilley[2] reports 5 interesting cases of ASPERGILLOSIS OF THE NASAL ACCESSORY SINUSES. He was unable to determine whether the condition was the result of the mycelium infection alone or whether this was grafted on a chronically inflamed antral mucosa. Clinically, the affection was characterized by marked nasal obstruction, discharge of a mucoid or slightly mucopurulent fluid, the occasional expulsion of small masses of white, gray, or semitranslucent viscous material, and more or less severe neuralgic pain in the face and cheek. The examination of the nasal fossæ showed that the mucous membrane was pale, swollen, and edematous, and did not contract upon the application of even a 20 per cent. solution of cocain. When polypi were removed from the ethmoidal region there was very little bleeding, and puncture of the inferior meatus through the antral wall gave no return of the fluid. All of his cases were operated on by the Caldwell-Luc method, and recovered without any incident of particular interest. The appearance of the interior of the maxillary sinus was characterized by the presence of a bluish-gray, glistening surface, somewhat resembling the appearance of a cholestomatous membrane of the mastoid antrum. There was a viscous and sticky material which was easily separated

[1] Jahrbuch f. Kinderheilkunde, February, 1915, xxxi.
[2] Journal of Laryngology, Rhinology, and Otology, April, 1915, xxx, 145.

from the walls of the sinuses, and this separation was followed by very little bleeding. Histologically the mass, as a rule, was found to consist of a homogeneous matrix through which were scattered groups of cells, probably polymorphonuclear leukocytes, and crystals, resembling the Charcot-Leyden crystals, found in asthmatic sputum, although not exactly the same shape. Throughout the whole material there was a well-developed mycelium which closely resembled the aspergillus.

Frontal Sinuses. A case reported by Glegg and Black[1] illustrates a rather unique procedure for the *determination of the existence and position of a brain abscess*. The patient, a soldier, had been operated upon twice for suppuration of the frontal sinus. At the second operation an area of carious necrotic bone was found in the centre of the posterior wall of the sinus, and by its removal the dura was exposed. However, a purulent discharge continued from the wound, and on readmission to the hospital a small amount of warmed Beck's bismuth paste was injected through the fistula, the greater part of which was retained. Radiograms were made on two occasions, both in the postero-anterior and lateral directions, and it was seen that the bismuth had collected in the right frontal lobe of the cerebrum. A third operation was carried out, and it was found that the fistulous tract from the lower part of the skin incision led to an opening in the dura. The opening in the dura was surrounded by granulations, and was situated at the upper edge of the bone hiatus on the posterior wall of the sinus. After dilatation of the fistula a strip of gauze was introduced through the dura and the discharge of pus ceased after four weeks, when the gauze drain was finally removed. This case is of special interest, as it illustrates the possibility of using bismuth paste combined with an *x*-ray examination for localizing the position of a brain abscess.

C. J. Imperatori[2] reports a case of general *meningitis following a second operation for suppuration of the frontal and sphenoidal sinuses*. The case was interesting in that the clinical symptoms at first were those of abscess, consisting of drowsiness, aphasia, paralysis of the right arm and partial paralysis of the right side of the face, with coma and slowing of the pulse. There was then no Kernig's signs, no Brudinsky, and no Babinski. An operative attempt to reach the supposed abscess was done, but with negative results. After this operation the spinal fluid pressure reached about 37 mm., and, two days before death, an organism was isolated which was apparently the influenza bacillus. Kernig's sign and cervical opisthotonos developed about three days before death. At the autopsy, general meningitis was found, cultures from which showed a small bacillus similar to that found by spinal puncture. The meningitis was especially marked in the region of the

[1] Lancet, January 16, 1915, p. 124.
[2] Laryngoscope, August, 1915, xxv, 580.

sphenoid and ethmoid bone, but there was no softening of the bone nor any extradural abscess. Careful cross-sectioning of the brain failed to show the presence of tumors or abscess formation.

MAXILLARY SINUSES. *Puncture of the maxillary sinus* through the inferior meatus *for diagnostic purposes* has become so widely used that with some specialists it is almost a routine procedure. In this regard it is well to remember that serious symptoms, even death, occasionally follow this apparent minor operative procedure.

A. Brown Kelly[1] calls our attention to these dangers. He reports 1 fatal case following perflation of the antrum through a cannula inserted through the inferior meatus. Further, he has seen a dozen or more cases in which minor, but somewhat similar, symptoms developed, and also a fatal case following perflation of the frontal sinus. In his search of the literature he collected 9 fatal cases and a fairly large number of others in which more or less serious symptoms developed. In the majority of these cases he says that the cause of death is very difficult to determine, and that most of the theories which have been advanced are inadequate. However, the greater number of fatal accidents have followed perflation, and in some of them the actual presence of air was found, at the autopsy, in the pulmonary artery.

Hajek considers that many of the less severe cases, such as sweating, cardiac palpitation, or slow pulse, which quite frequently follow exploratory washing when the fluid does not readily escape, are purely reflex phenomena.

O. St. J. Gogarty[2] makes a rather remarkable statement when he says that he has never seen an empyema in the frontal sinus unaccompanied by one in the antrum of Highmore. In this article he reviews some 300 cases in which he had operated on the antrum of Highmore for accessory sinus disease. Further, he considers no examination of the nose and throat complete, which does not include the washing out of the antrum of Highmore on each side.

This statement I believe to be one of the most injudicious remarks concerning the antrum of Highmore that has been published during the past year. To subject every patient who comes into our offices or into the hospital with nasal trouble to a puncture of the antrum of Highmore, whether disease of the cavity is suspected or not, is, I think, an unjustifiable procedure.

Concerning the etiological importance of the teeth in suppuration of the maxillary sinus, Harvard McNaught[3] states that very few cases result from tooth infection. In his series of 90 consecutive cases of chronic antral suppuration, very few had to be referred to the dentist, and he believes that the teeth alone were seldom responsible for infection of this

[1] Journal of Laryngology, Rhinology, and Otology, December, 1914, p. 556.
[2] Ibid., January, 1915, p. 9.
[3] Journal of American Medical Association, September 4, 1915, p. 872.

cavity. It does not seem probable, however, that McNaught can consider a careful examination of the upper teeth in maxillary sinus disease superfluous, for even though a dental origin occurs in only 10 per cent. of the cases, this frequency is enough to make us search for the dental factor in all cases, especially so since the failure to remove a carious tooth may prevent a cure.

The ease of approach to the maxillary sinus through the nasal fossa is making the *intranasal operation* continually more popular, especially so as the work can almost always be done under local anesthesia. Ross H. Skillern[1] has suggested a few improvements in technic which are worth noting. Under local anesthesia he proceeds as follows: A perpendicular incision is made slightly in front of, and above, the anterior end of the inferior turbinate extending well into the floor of the nose. This incision should sever all tissues down to the bone. The second incision is made directly back of this, meeting the first one above and below so as to excise a spindle-shaped piece of mucous membrane. The periosteum is then elevated from the crista pyriformis both externally toward the canine fossa and internally toward the inferior turbinate until a sufficient portion of the bone is exposed. The antrum is attacked with a chisel having a concave surface by applying it to the crista pyriformis above and below. The loosened piece of bone is then removed with a pair of strong forceps and the opening into the antrum can be enlarged by the same method, or, better, by an electric trephine, which insures a smooth round opening and prevents spicules of the bone being driven into the sinus. An ordinary curved frontal sinus rasp may also be used to enlarge the opening. The sinus is then flushed out and packed with a thin strip of gauze saturated with cocain-adrenalin solution and allowed to remain for five minutes. After inspection through an ordinary hard-rubber ear speculum, all the diseased and degenerated mucosa is removed, and the cavity is again cleansed and irrigated, dried out and packed loosely with iodoform gauze. This gauze is removed in from forty-eight to seventy-two hours, depending upon the amount of secretion, or, if the wound remains moderately dry, it may even be permitted to stay in as long as a week. The packing should be reinserted every second day, for from ten days to two weeks, when it can be permanently discontinued. Curetting of the edges and the use of caustic are generally necessary to prevent the closing of the opening. The removal of the crista pyriformis does not in any way interfere with the normal appearance of the face.

In a critical review of different methods of operating on maxillary sinusitis, George P. Marquis[2] deals chiefly with the choice of operation. He said that the operation of choice would be that one which permitted

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[1] Laryngoscope, November, 1914, p. 901.
[2] Annals of Otology, Rhinology, and Laryngology, March, 1915, p. 2.

the most thorough work, gave the best access to the whole of the sinus and the best inspection of the sinus, and which permitted the most rapid healing, leaving the parts in their normal relation and the antrum least liable to reinfection, and also would be least liable to be followed by unpleasant or even serious symptoms, such as local areas of anesthesia due to severing of the nerves, occlusion of the nasolacrimal canal, facial deformity, fistula into the mouth and so forth. Marquis himself believes that the Denker operation with the modification suggested by Cordes, which preserves the inferior turbinate, probably gives the most successful and satisfactory method thus far advanced. The advantages of the Denker operation over the Canfield is that Denker, by his incision through the mouth, obtains a greater field in which to carry out his manipulations. He says that the only disadvantage which could be brought against this method of operating is that in cutting through the substance of the superior maxillary bone, composing the anterior wall of the antrum, the anterior dental branches of the fifth nerve which supplies the three front teeth is completely severed.

In the discussion which followed the reading of this paper, some of the most prominent American specialists took part in it, and it will be exceedingly instructive to briefly review the expressed opinions. The majority of the speakers were agreed that the Denker operation, when a radical procedure was necessary, was the operation of choice; though Ballenger did not believe that there was any advantage in using the nasal mucous membrane as a flap to be carried into the antrum. Further, he does not pack after the operation, and thought it inadvisable to curet out the contents of the sinus in the majority of cases. Hollinger agreed that the mucous membrane of the antrum should not be curetted even when polypoid and degenerate. He said that Denker himself only removed the mucous membrane from the floor of the cavity. A. H. Andrews also believes in the uselessness of the flap, and advised against postoperative irrigation of the cavity. Ballenger and Corwin also advised against irrigation.

J. C. Beck did not consider the Denker operation sufficiently radical for intractible cases and that in these cases one should make an attempt to obliterate the cavity. He has in 2 cases found that obliteration did take place, as proved in one by a second operation and in another by direct inspection with the nasopharyngoscope.

N. H. Pierce confessed to a sense of uncertainty as to the outcome of any given operation for emphysema of the maxillary sinus, and says that some cases of comparatively great severity did well after simple drainage through the inferior meatus, while in some cases, even with the most radical procedure, he had failures. The majority of the speakers agreed there existed this uncertainty as to the final outcome.

Shambaugh had seen favorable results from operating through the middle meatus, and that even when polypoid degeneration of the mucous

membrane of the antrum is present, the establishment of free ventilation, which permits the air to enter freely into the sinuses, would frequently bring about a cure without further interference. For this reason the first operation of choice should not be a radical one, such as Denker's, but rather a more simple procedure, such as opening through the middle meatus.

Otto J. Stein said that his experience has led him to feel less and less inclined to perform any of the radical operations mentioned.

Marquis, in closing his discussion, stated that he did not mean to say that the Denker operation should be performed on every patient who presented themselves with chronic antral suppuration, but that it is the best operation when the simple methods fail.

The SPHENOIDAL SINUS probably presents more difficulties in diagnosis than does any other of the accessory sinuses of the nose. To make a positive differential diagnosis between disease of the sphenoidal sinus and that of the posterior group of ethmoidal cells, the washing out of the former cavity is absolutely necessary. In a fairly large number of cases a little patience on the part of the examiner will enable him to pass a catheter through the normal opening of the sinus. In some cases, however, this is impossible, and in others is attended with considerable discomfort on the part of the patient.

C. P. Grayson[1] advocates the exploratory opening of the sphenoidal sinus, using for this purpose a small hand drill which penetrates the anterior wall close to the floor. I have found that when the probing of the normal opening is impossible or difficult, this simple maneuver of Grayson's can be accomplished easily and apparently without danger. Grayson's technic is as follows: The turbinates are shrunk and the field of operation anesthetized with cocain and adrenalin. When this has been done, the course of the sphenopalatine artery is usually so plainly visible that it can easily be avoided. The application of a diluted tincture of iodin is sufficient for purposes of sterilization. A straight drill is used, with a conical burr 6 mm. in length and measuring $2\frac{1}{2}$ mm. from its point to its greatest diameter. This drill also should have a collar just back of the burr to prevent its slipping into the cavity and striking against the posterior wall. The drill is applied at a point 2 or 3 mm. above the line which divides the anterior from the inferior surface of the sphenoid body, close to the attachment of the septum in the middle line. The opening made is about 2 mm. in diameter and is quite sufficient to permit the escape of any fluid within the sinus or the introduction of an appropriate irrigating cannula. Should it seem advisable, the distal jaw of the biting forceps can be carried through the opening and its diameter enlarged; also this opening may be later used for more or less extensive removal of the anterior wall should disease of the sinus

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[1] Laryngoscope, February, 1915, xxv, 65.

make it necessary. The chief advantage of this method of puncturing the sphenoidal cavity is that the operation can be done without even a partial ablation of the middle turbinate. Grayson has used this method of perforating the sphenoidal sinus in a large number of cases, and has never known a patient to complain that the operation was painful. There was no shock and the bleeding is not more than a trace  In discussing the anatomy of the sphenoid, Grayson calls attention to the fact that in the first place the floor of the sinus, with remarkably



FIG. 18.—Lateral view of external wall of nasal fossa and sphenoid sinus with relative situations of the anatomical and surgical openings of the latter.

few exceptions, lies not more than 2 or 3 mm. above the crescentic line which marks at once the base of the sphenoid body and the upper margin of the posterior choana. Also the examination of a large number of skulls by numerous investigators has demonstrated that the septum between the two sinuses, however much it may deviate to one side or the other posteriorly, almost invariably occupies the middle line in front.

A case of HYPOPHYSEAL GROWTH OPERATED ON BY THE INTRANASAL ROUTE and reported by Otto J. Stein[1] is interesting in that he demon-

[1] Laryngoscope, March, 1915, xxv, 159.

strates the tolerance which brain tissue sometimes shows to injury. The operation was done under scopolamin and morphin, combined with local anesthesia. A submucous resection of the septum was done and one middle turbinate removed.

The mucoperiosteum was elevated from the anterior surface of the sphenoid and the cavity opened. While swabbing, shortly before finishing the decompression operation, the probe entered the brain on the left side, causing immediate collapse of the patient, with unconsciousness, paralysis, retarded breathing, slow pulse, buccal relaxation, dilated pupils, etc. The operation was hastily finished and the patient finally recovered, although some disturbance of sensation was noticed in the right leg for ten days. The immediate results of the operation on the hypophyseal symptoms were exceedingly good.

**Pharynx.** W. Sohier Bryant,[1] in his study of the mucosa of the nasopharynx, has discovered an area in which a transitional epithelium exists. This zone he found not only in man but in the rabbit, guinea-pig, cat, and two varieties of monkey. This intermediate zone of cells is placed between the squamous cells of the pharynx and the ciliated columnar cells of the nose and the nasopharynx. The epithelium which occupies this transitional zone is composed of cuboidal cells with either imperfect cilia or no cilia at all, and represents a type half-way between that found in the nose and that in the pharynx. The exact location of this zone varies in the different animals. He found that the squamous epithelium generally extended forward to the fossa of Rosenmüller, while the ciliated columnar epithelium extended backward from the nose to a variable distance, usually reaching to the Eustachian tube. The intermediate zone of modified epithelial cells fills in this space between the squamous and the columnar epithelium. The zone may be represented by a wavy line crossing over the rhinopharynx, bending forward on the anterior and posterior walls and backward on the lateral wall and the attachment of the posterior faucial pillar. In man the anterior border crosses the Eustachian orifices, and the posterior border is a short distance behind the orifice.

O. Levinstein,[2] in a very elaborate article, invites our attention to the importance of INFLAMMATORY DISEASE OF THE LATERAL PHARYNGEAL FOLD. The etiology of inflammation of this region is similar to that of ordinary pharyngitis. It frequently follows as the result of mouth breathing, irritation from a dusty atmosphere, irritating gases, the excessive use of tobacco, disease of the sinuses, and especially improperly seasoned food and alcoholic drink. The condition may exist either as an acute or chronic affection, and both the acute and chronic forms may be of a simple inflammatory or of a follicular or cryptal type. It is well

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[1] Laryngoscope, June, 1915, p. 346.

[2] Archives f. Laryngologie und Rhinologie, 1915, xxix, Heft 3, p. 403.

to recall that the swelling of the lateral folds of the pharynx, such as is found in lateral pharyngitis of the chronic type, is due to a formation of a layer of adenoid tissue resembling in almost every detail ordinary tonsillar tissue. It possesses crypts, germinating follicles, etc., and, further, Levinstein has noted the migration of leukocytes and lymphoid cells into and through the epithelium, as has been so frequently seen in tonsillar tissues. In acute cases the leukocytes predominate, whereas in chronic cases he says the lymphocytes predominate. The crypts of the lateral pharyngeal fold, just as in tonsillar tissue, are sometimes empty, and sometimes contain material made up of epithelial cells, lymphocytes and leukocytes, and all forms of bacteria.

The *symptoms* of inflammation of the lateral fold of the pharynx are interference with speech, pain on swallowing, sense of fulness in the ears, and general symptoms of toxemia, varying in degree, depending upon the severity of the infection and whether it is acute or chronic. Usually the diagnosis of the condition presents few difficulties, provided the throat is carefully examined. The chief difficulty rests in the fact that the symptoms of lateral pharyngitis are in many points similar to those of ordinary pharyngitis and to inflammation of the faucial tonsils; also, frequently the symptoms complained of by the patient are much greater than warranted by the apparent condition of the throat, so that one readily overlooks the real cause of the patient's discomfort. The treatment of this condition consists first of all in the removal of all etiological factors, such as the correction of deformities of the nose, the cure of accessory sinus trouble, the avoidance of irritating substances of food or drink, and, when necessary, the improvement of the general health of the patient.

Lateral pharyngitis may be treated conservatively with throat washes, astringent sprays and pigment, and of course this is especially true in acute inflammation. If there is marked hypertrophy of the lateral fold, cauterization with chemicals should be tried, and, when this fails, the use of the galvanocautery is indicated. In the chronic cases where there is only a moderate degree of hypertrophy, the galvanocautery is sufficient. When the swelling is marked, extirpation of the lateral fold by a bloody operation should be done.

The large majority of ABSCESSES OF THE PHARYNGEAL WALL are due to the breaking down of either the retropharyngeal or the deep lateral pharyngeal lymph nodes. Sometimes it occurs as the result of a cervical Pott's disease, but is an extremely rare condition when arising from an otogenic source. Dan McKensie[1] quotes Holmes, 1906, who, when reporting a case which later appeared in the *Annals of Otology*, stated that he had been told by no fewer than 147 of his colleagues that they had never seen a case. McKensie says that there are four different

[1] Journal of Laryngology, Rhinology, and Otology, January, 1915, p. 12.

ways by which disease of the ear and the surrounding adnexa may lead to a pharyngeal abscess: (1) By a direct extension, the disease finding its way from the middle ear to the petrous bone and thence to the pharynx; (2) an extradural abscess of the middle cranial fossa may find its way to the tip of the petrous bone and thence by the foramen lacerum anticum, or otherwise, gains access to the extracranial, inferior surface of the bone; (3) by a direct extension of the purulent disease from the pneumatic cells in the typanomastoid osseous structure to the under surface of the occiput and thence to the pharynx; (4) by the extension of an extradural abscess of the posterior cranial fossa to the same suboccipital region. The first two methods, in both of which the pus reaches the pharynx from the region of the tip or under surface of the petrous bone, may be termed the subpetrous varieties; the last two, in which the pus reaches the pharynx by way of the under surface of the occiput, the suboccipital varieties.

The *symptoms* of otitic pharyngeal abscess are not always prominent, and, in many cases, the discovery of the abscess seems to have been accidental, and in a few the pharyngeal condition has been unsuspected until found at the autopsy. Usually, however, there is pain on swallowing, and, in a case reported by McKensie, the symptoms present were so characteristic and indicated the location of the phlegmonous lesion so precisely that he believes that they are the inevitable accompaniments of abscess in the deep pterygoid and pharyngeal region. In cases of the subpetrous type, there are few symptoms outside of those directly due to the ear condition and the suppurative process of the pharyngeal wall. In the suboccipital, apart from the local pharyngeal symptoms, the condition differs markedly from the subpetrous type, the most prominent phenomena being those due to a cellulitis of the posterior cervical triangle. Always a combination of ear discharge with evidence of a pharyngeal abscess should awaken suspicion, and this suspicion is strengthened if there is present temporal or facial edema, with fixation of the jaw, or a cervical cellulitis.

The *prognosis* of these cases is serious until the pharyngeal abscess has been found and opened. When this is properly done, there is a rapid lessening both of the constitutional and of the local symptoms. The reason for the improvement following the opening of the pharyngeal abscess is that the pharyngeal extension is generally the most dependent pocket of a very diffuse and widespread abscess, hence the pharyngeal incision gives the best possible drainage. Otogenic pharyngeal abscesses are now much more rare than they used to be, and this because of the early opening of the mastoid cells in inflammation of this bone. When the diagnosis of a suspected extension of the mastoid disease toward the pharynx is made before there is a real pharyngeal abscess, the method of attack should be to perforate the anterior bony wall of the external auditory meatus. This opening, when made close to the tympanic

membrane, should lead to the subpetrous abscess. Once the pharyngeal abscess has formed, however, it is more easily and safely opened through the mouth, and, unless there is an extensive and progressive cervical cellulitis, it is usually not necessary to open the abscess from the outside of the neck. When, however, there is a cervical cellulitis, as occurs in the suboccipital variety, the sternomastoid muscle should be detached from the tip of the mastoid after the cells have been opened up. The tip is then removed and by careful dissection, following the bone around the disgastric fossa, a free exit may be gained to the suboccipital region. Sometimes, in this dissection, ligature of the occipital artery is necessary. However, even in the suboccipital variety if there is a pharyngeal abscess already present, it should be opened through the mouth.

**Tonsils.** Because of the peculiar anatomy of the lymphatic tissues of the throat, because of their somewhat indefinite physiology, because of their great importance from the clinical standpoint, and because of their accessibility to operative attack, these structures still occupy a lion's share of interest for the nose and throat specialist. In spite of the enormous amount of research work and clinical observation, the technic of operative procedures that have been published each year shows a great amount of literature, exceeding probably all other publications on the nose and throat put together. The anatomy of these structures, their topographical relations and their histological formation is pretty well established, while their physiological importance, both in health and disease, and the effect which they exert on the general system, remains in a very indefinite state.

Considerable work has been done on TONSIL EXTRACT, though the various investigators are not at all unanimous as to its effect on the body function. The difference of the results obtained by these men is probably due to the fact that the influence of the extracts on the general system is not due so much to the tonsil itself as to the bacteria and other products found in the crypts, and to the various reactionary products in the tonsillar tissue resulting from the presence of these organisms.

A most interesting piece of work has been done by Burmeister and Dick.[1] They had previously demonstrated that, from those tonsils which were highly toxic, colonies of hemolytic streptococci could be obtained; and it was further noticed that, unlike the anaphylatoxin of Friedberger, the toxicity of an extract made from these tonsils was not entirely destroyed by heating to 65° centigrade, but simply diminished without rendering it entirely non-toxic. This led to the belief that the toxicity of the extract was dependent in part upon an anaphylatoxin of bacterial extraction, and also in part upon an unknown heat-resisting portion. The present study by Burmeister and Dick was devoted to the object of determining just what this latter

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[1] Journal of Infectious Diseases, November, 1914, No. 3, p. 519.

portion was. This elaborated bacteriological and experimental study led them to the following conclusions:

"In conclusion, then, it may be said that the hemolytic streptococcus is present in tonsils, the extracts of which are most toxic, and it is logical that the toxicity of the extracts must depend in part on toxic products elaborated out of the streptococcus itself, or by the action of the streptococcus on the tissue in which it was growing; or, that both hypotheses may be true. A further study of this phase should be undertaken.

"The tonsils, the extracts of which are toxic, contain a considerable amount of heat non-coaguable biuret-reacting substance, in all probability a product of the splitting of the proteins *in loco*. This splitting no doubt is due in part to the action of saprophytic or pathogenic microörganisms on the tissue of the tonsil. It is not improbable, however, that part of this splitting action may be due also to the action of a ferment for tonsillar tissue contained in the blood, and which resembles an amboceptor and requires a complement to complete its action. It is plausible to assume that local death of tonsillar tissue, by the action of organisms like the streptococcus, permits of the parenteral absorption of tonsil protein and results in the formation of an amboceptor for this protein which, with the aid of the complement, is capable of splitting the protein. This splitting action then might occur *in loco*, or, following the parenteral absorption of tonsil protein, in the circulating blood. The toxic action of tonsillar products may then, in part at least, be responsible for many of the clinical symptoms manifested in the course of disease of the tonsils. The individual, becoming sensitized to his tonsils, exhibits, from time to time, mild or severe symptoms due to the toxic products of tonsillar origin. The effect on the individual of continued sensitization in this manner can only be surmised. Longcope has been able to produce an interstitial hepatitis somewhat resembling cirrhosis,[1] a myocarditis with scar formation and a glomerular and a parenchymatous nephritis[2] in rabbits, cats, guinea-pigs, and dogs by repeated sensitization with proteins. The frequency with which myocardial and renal lesions are found accompanying and following acute and chronic tonsillar conditions has long been known. These secondary conditions have been attributed, usually, to the systemic bacterial invasion with the tonsil as the atrium. This, no doubt, is in most cases the predominate etiological factor; but it does not seem improbable that some of these conditions may be due, in part at least, to toxic protein products of tonsillar source."

A clinical study of the *action of tonsillar extract in cases of diabetes mellitus* is published by Farmachidis and Vattuone.[3] They injected the tonsillar extract intravenously every day, using doses from 2 to 20 c.c.

[1] Transactions of the Association of American Physicians, 1913, xxviii, 98.
[2] Journal of Experimental Medicine, 1913, xviii, 678.
[3] Riforma Medica, December 19, 1914.

They claim that there was a primary increase in the glycosuria which, however, was soon followed by a rapid decrease. This was accompanied by a marked improvement in the other symptoms, such as increase in weight and muscular power. In a few other cases an acetonuria disappeared after a few months of treatment.

The reason for this peculiar action of the tonsillar tissues on diabetes mellitus is possibly somewhat obscure, but it is an interesting clinical observation.

Russel L. Cecil[1] publishes the results of a careful study of infections of the upper respiratory tract due to the Streptococcus viridans. He found that this organism was predominate in more than one-half of the cases studied and was present, but not predominate, in a good many others. In 21 cases in which the tonsils showed more or less evidence of tonsillar disease, he found the streptococcus present in large numbers in 16 and in some of these in pure culture. In the remaining 5 cases the pneumococcus and Streptococcus hemolyticus were predominate. In 5 cases of acute tonsillitis associated with rheumatic fever, the Streptococcus viridans was the predominate organism in all of the tonsils, and in one case it was present in pure growth. This is an interesting finding in view of the fact that Rosenow has recently cultivated, from the joints in rheumatic fever, a streptococcus which produced green on blood agar and, after prolonged cultivation, came to resemble the Streptococcus viridans in morphology, as well as in cultural and pathogenic quality. Cecil found, in 2 cases of subacute infectious endocarditis where there was no external sign of disease of the tonsil, that cultures from the crypts gave practically a pure growth of Streptococcus viridans, and that strains of the Streptococcus viridans from the tonsils in these 2 cases reacted on culture media in the same way as those recovered from the blood, though morphologically the cocci from the tonsils were somewhat larger than those from the blood. On the other hand, out of 9 cases of accessory sinus disease the found the Streptococcus viridans predominating in only 3, and in 13 cases of infection of the middle ear this organism was found in only 1, and in this case the mastoid was not involved. Cecil says that, as shown by the general clinical course, an infection from Streptococcus viridans in the upper respiratory tract seems to possess three very definite characteristics: (1) They usually run a mild course, as the Streptococcus viridans is essentially a germ of low virulence, both in animals and in man; (2) they have a tendency to become chronic, particularly in pyorrhea, tonsillitis, and sinusitis; (3) they are followed by little or no immunity and are therefore quite prone to recur at frequent intervals.

This last characteristic is extremely interesting to me because of the failures which seem to have followed in cases of rheumatic fever and

[1] Laryngoscope, February, 1915, xxv, 97.

chronic rheumatic arthritis following the use of vaccines. If the Streptococcus viridans infections do not develop immunity when the living organisms are present in the tissues, it does not seem rational to believe that an immunity can be developed by the subcutaneous injections of the dead organisms. The removal of the source of infection, that is, the extirpation of the tonsils, is a much more rational procedure.

The results obtained by F. C. Pybus[1] are rather in favor of the theory that at least a certain percentage of cases of rheumatic arthritis derive their infection through the tonsillar tissues. In his inoculation experiments, made with organisms obtained from the tonsils, he found that in animals injected with the tonsillar microörganisms from 15 cases with a history of rheumatism, joint lesions developed in 7 cases, that is, 47 per cent. Whereas the organism obtained from persons without a history of rheumatism, 5 in number, 4 of the injected animals developed septicemia and only 1 arthritis.

Somewhat different results were obtained by Roland Hammond[2] who made a careful study of the condition of the nose and throat in 61 cases of chronic infectious arthritis. All of these cases were referred to him by nose and throat surgeons for examination and treatment. Out of the 61 cases, only 12 were operated on, and only 5 of these 12 cases showed any improvement, while, on the other hand, in 10 for whom operation had been advised, but who had refused to have it done, 4 showed improvement without operation. In all of these cases the advice for operation was based entirely upon the clinical appearance of the tonsil, and there was no attempt made to establish a relationship between the disease of the nose and throat and the arthritic infection.

There is little doubt now that TUBERCULOUS CERVICAL ADENITIS in the large majority of cases owes the conception of its infection to the faucial and pharyngeal tonsil. Richards[3] says that presumably 80 per cent. of the cases of tuberculous adenitis of the neck result from tonsillar infection, and recommends that in all cases of cervical adenitis, the tonsils should be removed before operating on the cervical lymph nodes.

In spite of the work that has been done in the last three years by Winslow, of Boston, by Capps and Miller, of Chicago, Davis and others, Smith and Brown[4] do not believe that the evidence furnished is satisfactory as proving that the bovine streptococci associated with mastitis or garget are the etiological agents of tonsillitis in man.

An epidemic of rather mild tonsillitis which occurred in the New York State Hospital for Incipient Tuberculosis at Ray Brook, New

[1] British Medical Journal, May 22, 1915, p. 884.
[2] Journal of American Medical Association, September 25, 1915, p. 1091.
[3] Boston Medical and Surgical Journal, July, 1915, clxxii, No. 1.
[4] Journal of Medical Research, January, 1915, xxxi.

York, is reported by H. A. Bray.[1] This epidemic was sharply localized to the sanitarium but showed no predilection for any one division of the sanitarium, the distribution of the cases being fairly uniform. Examination of the water supply proved it to be normal, but, on tracing back the milk supply to one of the two farms from which it came, it was found that one of the milkers on the farm had had a slight tonsillitis which kept him in bed for three days, and another child of the same family had developed tonsillitis which was clinically similar to the cases at the sanitarium. The cows were healthy. Although it was impossible to trace the infection directly from the milk, it was believed that the circumstantial evidence as to the etiological importance of the milk was very close to a certainty. A further study was made as to the effect which these acute tonsillar involvements might exert on the tuberculous condition. Only 5 tuberculous cases and 1 non-tuberculous patient showed any particular injury as the result of the local inflammation. In all of the others the fever returned either to normal or to that limit which was previously present in the case, as soon as the local inflammation was over. Weight, which was lost during the tonsillar attack, was rapidly regained. There was no increase in the amount of sputum or in the number of bacilli. In the 3 cases of laryngeal tuberculosis there were no untoward local effects produced by the acute infection. All of the cases showing depreciation as a result of the tonsillar condition exhibited some pleuritic involvement. Bray calls attention to the fact that in milk-borne epidemics of sore throat of bovine inception, the condition is generally very severe and followed by serious complications having a relatively high mortality, whereas, and in striking contrast, the present epidemic was characterized by a mild form of infection with few accompanying complications and no mortality. The infection in this epidemic was probably carried in the milk, but was not bovine in origin.

J. H. Young[2] has studied 21 cases of CHOREA who had had a tonsillectomy performed either before the patient first came under observation or while under observation. Of the 21 cases, only 6 gave histories of previous tonsillitis; 5 cases gave a history of previous arthritis before the tonsillectomy, and 2 of these had subsequent attacks. Nine cases had chorea before the operation, and 8 of these had attacks since then, and there were 4 patients who had had attacks of chorea since the removal of the tonsils, with no history of previous attacks. Of the 21 cases, at the time the report was made 17 cases showed chronic endocarditis, and, of these, only 12 were known to have had endocarditis before the tonsil operation. Three patients were known to have had a fresh endocarditis or an acute exacerbation of a chronic endocarditis

[1] Journal of American Medical Association, April 3, 1915, lxiv, 1127.
[2] Boston Medical and Surgical Journal, September 2, 1915.

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since the operation. Young believes that since out of 21 cases there were 12 cases of chorea, developing after tonsillectomy, the removal of the tonsils does not offer the protection against chorea, and the same may be said of endocarditis, that many have heretofore believed.

The indications for the removal of the faucial and the pharyngeal tonsils are sometimes so clear that it leaves very little doubt concerning the advisibility of the procedure. On the other hand, there are many cases in which wise advise on the part of the physician is most difficult to give. I sometimes look with wonder at the practitioner who can say, by simple inspection of the tonsil, that this tonsil should come out or this tonsil should stay in; that this tonsil is diseased or this tonsil is not diseased. Of course, there are cases in which gross pathologic lesions make vivid pictures, but in by far the greater number of cases in which operation is indicated, there is comparatively little to be gained by inspection of the tonsil itself. This is more expecially true of those cases in which the operation is undertaken for the relief of cryptogenetic infection.

Gilbert D. Murray[1] strikes very nearly the truth when he says: "Having had an average experience in tonsil work, the writer is free to say that he cannot by direct examination of the tonsil tell whether there is focal infection. The decision to operate must always be supplemented by the history." From an experience of 848 cases of tonsillectomy, 448 of which were followed up after the operation, he obtained satisfactory results in 275. The result was not known in 151, and in only 22 were the cases referred for further treatment. The indications for the operation in the 448 cases were infection and obstruction. Infection and obstruction were combined in 158, infection alone in 125; and obstruction alone in 158. In 94 of the operations there was unusual hemorrhage, requiring ligation of some artery in 34. He does not believe that in every case of nasal obstruction it is necessary to remove the tonsils, as a great many obtain complete relief after a simple adenectomy.

While with a great many specialists today the operation of tonsillotomy has been simply a stepping stone to the more perfect procedure, tonsillectomy, we note that T. R. French[2] still believes it advisable in many cases not to interfere with the tonsillar capsule. His reasons for the retention of the capsule are, that possibly there is an existence of a tonsillar function and also the danger of pharyngeal deformity and the consequent alterations of the quality of the voice is greater following the tonsillectomy than after a tonsillotomy. If the tonsil is extensively diseased, he believes it should be enucleated, but it probably is safe to say that at least 80 per cent. of enlarged tonsils do not contain disease foci and therefore do not need to be completely removed, and, indeed,

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[1] Pennsylvania Medical Journal, August, 1915, p. 853.
[2] New York Medical Journal, December 5, 1914.

unless obstructing the voice or respiration do not need to be removed at all. In doubtful cases, French removes a substantial portion of one tonsil at the time of the operation and submits it at once, in a brilliantly illuminated field, to examination under a finely ground loupe, with a magnification of from 5 to 10 diameters. He believes, that by this way he can detect any disease in the tonsil. If the disease is not found and the clinical history is without significance, the tonsils should be removed down to, but not including, the capsule. The opposite tonsil, if not obstructing, may then with propriety be left alone, but, if obstructing, it also should be removed by complete tonsillotomy, that is, down to the capsule but not including it. Should, however, disease be found in the exploratory section, then both tonsils should be enucleated.

If it could be believed that it is possible to detect, even in a fair proportion of cases, obscure disease of the faucial tonsils from a small section of the tonsil examined under a simple magnifying glass, it might seem justifiable to increase the length of the operation necessitated by such an examination. I do not, however, believe that any important data as to disease of the tonsils or important cryptogenetic infection can be obtained by such procedure. A careful microscopic examination of the tonsils where numerous sections are cut and properly stained and then examined under the higher power of the microscope, even if it could be made before operation, would in itself not be conclusive evidence as to the advisability of removal of the tonsil. The absorption of toxins, the formation of antibodies in the parenchyma of the tonsil, the parenteral absorption of foreign protein and other biological processes, all of which are extremely important in the study of the relation of the tonsil to the general system cannot possibly be determined by inspection, either macroscopically or microscopically, of the tonsil itself. Therefore, clinical observation, the reaction of the patient's serum, and a careful study of the history give more important data than does inspection of the tonsil.

As a rule, it is better to wait before the performance of tonsillectomy until all acute condition of the tonsil or the upper respiratory tract has subsided, but sometimes, as suggested by W. G. Harrison,[1] it may be wiser to perform the tonsillectomy during an acute attack of endocarditis, and so remove the source of infection, than delay with the hope of operating after the attack has subsided. Harrison says that cleansing of the tonsillar crypts by local application and syringing with an antiseptic solution should be tried, but, in spite of the most assiduous care, it will sometimes be impossible to eradicate every focus. When operating for endocarditis, the tonsils should be preserved and vaccines made from its crypts with which the patient can be treated if the fever and

[1] Southern Medical Journal, January, 1915.

other signs of infection do not disappear within a reasonable time after the operation.

A rather interesting case showing a possible result of tonsillar infection is reported by Oscar Beck.[1] The clinical symptoms were those of meningitis, and the condition was not thoroughly understood until the autopsy. At the autopsy there was found a rather rare sequence of events, following a purulent tonsillitis. A retro- and suprapharyngeal abscess had developed, and as it increased in size pressed upward against the base of the skull, destroying the bone in its entire thickness and involving all of the left posterior cranial fossa in a large subdural abscess. Nothing pathological could be noticed in the mucosa of the mouth or pharynx and the tonsils seemed normal, but by cutting deeply into the tonsillar tissue, a large amount of pus was brought to light especially on the left side. One could follow the course of the infection from the left tonsil along the roof of the pharynx so plainly at autopsy that no doubt can exist but that the whole process must have originated in the tonsil. The retro- and suprapharyngeal abscesses were not recognized clinically, probably due to the fact that the first symptoms began when the abscess broke through the floor of the skull and exerted pressure on the dura.

At the present time ENUCLEATION OF THE FAUCIAL TONSILS is almost universally employed as the OPERATION OF CHOICE in the surgical treatment of these structures. There is still considerable diversity of opinion as to the best method of doing the enucleation and the past year has added very little to out technic. D. C. Balfour,[2] operating at the Mayo clinic, uses the dissecting method, pure and simple. The operation is as follows: Under deep general anesthesia the index-finger is introduced behind the posterior pillar of the tonsil and firm upward traction of the tonsil is made, so that the anterior pillar is put on the stretch. Then, with blunt scissors or tissue forceps, the pillar is dissected from the anterior part of the tonsils, care being taken not to break through the capsule. This enables the operator, by means of the finger pressing from behind, to force the tonsil well forward and securely engage it with the tenaculum. The tonsil is then rotated to expose the posterior pillar, which is likewise freed by a blunt dissector. The superior pole of the tonsil is now enucleated from the supratonsillar fossa, and, in the majority of cases, the tonsil may be rolled out of its bed without any more than blunt dissection. When the tonsils are very adherent, and the pillars cannot be separated by blunt dissection, careful clipping with the dissecting scissors will free the tonsil from the pharyngeal wall. Balfour claims that this operation demanding few instruments possesses distinct advantage for the general surgeon.

[1] Annals of Otology, Rhinology, and Laryngology, March, 1915, xxiv, 125.
[2] Annals of Surgery, March, 1915, p. 257.

Wm. Hill and G. J. F. Elphick[1] have devised a rather ingenious instrument, which they call a tonsillectome, by which they claim they can do practically a bloodless operation. This tonsillectome in general construction resembles somewhat the Sluder-Ballenger instrument. The instrument, however, has two blades. One is a dull, crushing blade which may be smooth or serrated, and which is driven home by action of the handle. There is a catch arrangement to retain the crushing blade hard against the stump for as long as seems expedient. The other blade is sharp, manipulated by digital pressure and cuts the tonsil loose, passing through it between the tonsil and the dull blade. For complete hemostasis, the instrument is left attached to the stump after the removal of the tonsil for one or two minutes longer than the previouly ascertained clotting time of the patient's blood. However, in ordinary practice the operation is usually done with scarcely any pause between the cutting of the tonsils and the unclamping of the stump, as the authors feel that under ordinary circumstances the amount of blood lost is trifling when compared with the average amount after the employment of one of the sharp-bladed guillotines.

LaForce[2] has developed a somewhat similar instrument.

There is no doubt, if one employs an instrument such as the Sluder or the Sluder-Ballenger, that the use of a crushing blade, as just described, is an advantage. Personally, I prefer to dissect with a final severing of the tonsil by the cold wire snare. If hemostasis is desired, the snare can be left on before final severing of the tonsil for a number of minutes according to the coagulation time of the patient's blood and just as complete stasis can be obtained as described by Hill and Elphick.

The anatomical study of Balatnikow[3] is of interest in relation to tonsillar hemorrhage. It represents a great amount of work on the topography of the lateral pharyngeal region and the relation of the large bloodvessels to the tonsils. Some fifty, or more, pages are devoted to the description of dissections, measurements and to the portrayal, with pictures and diagrams, of the relations of these parts. His results are well summarized in seventeen conclusions, which we quote:

"First. The topographical relation between the large vessels and the lateral pharyngeal wall depends largely upon the development of the bony parts of the skull in that region.

"Second. On account of the poor development of the viceral portion of the skull, the bloodvessels lie closer to the tonsils in adults than in children.

"Third. The distance between the bloodvessels and the lateral pharyngeal wall is a changeable one, and depends upon a great number of facts.

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[1] Journal of Laryngology, Rhinology, and Otology, December, 1914, p. 545.

[2] Laryngoscope, January, 1915.

[3] Archiv. f. Laryngologie und Rhinologie, 1915, xxix, Heft 2, p. 225.

"Fourth. The position of the head has a great influence on the topography of the vessels and their relation to the tonsils. The maximum of change in the position of the vessels is observed on turning the head. The bloodvessels are closer to the lateral pharyngeal wall on that side from which the head is turned away, while on the opposite side they are farther away.

"Fifth. It is possible, by the contraction of an individual group of muscles, to cause alteration in the position of the bloodvessels.

"Sixth. The distance between the tonsils and the internal carotid artery is about $1\frac{1}{2}$ cm. and between the tonsil and the external carotid artery 2 cm. The distance, however, is very variable. Sometimes it is quite considerable but more frequently just a smaller alteration is found.

"Seventh. At postmortem, traction of the tonsils, pressing down of the tongue and opening of the mouth has no influence on the position of the bloodvessels. In the living, however, it is possible to produce such changes, especially when there is an infiltration of the peritonsillar tissue.

"Eighth. Besides the internal and the external carotid artery, the pharyngeal wall is in intimate relation with the facial, the lingual and ascending palatine artery, and sometimes with the ascending pharyngeal artery, as well as the submucous peripharyngeal plexus of veins.

"Ninth. The importance of the bouquet Riolan (a cluster of ligaments and muscles attached to the styloid process) as a protection to the bloodvessels cannot always be relied upon as their relation varies according to the height of the cut.

"Tenth. Hemorrhage following an operation on a peripharyngeal abscess may come either through wounding of the arteries (as mentioned under six and eight) or from the veins when they are distended or varicose.

"Eleventh. Tonsillotomy, when properly carried out, should only be followed by capillary or venous bleeding, as the arterial branches only reach the tonsil capsule and enter into the tissue of the tonsil as capillaries. In complete extirpation of the tonsil with the capsule, it is possible to have severe arterial bleeding.

"Twelfth. Because of the possibility of an anomalous position of the bloodvessels, it is essential before every operation on the pharynx and tonsils that their presence should be ascertained by careful palpation.

"Thirteenth. The size of the lateral pharyngeal space is inconstant. The amount of cellular tissue varies and sometimes the so-called space appears only as a slit through which the bloodvessels pass.

"Fourteenth. In doing a tonsillotomy, only that portion of the tonsil should be removed which projects into the throat. The tonsils should should not be pulled out of their niche nor should the instrument be pressed hard against the lateral wall of the pharynx

"Fifteenth. In opening up a peripharyngeal abscess, the following rules should be followed:

"1. The opening should only be done when all precautions to check bleeding have been taken, having instruments ready to sew the pillars or even to ligate the common carotid artery.

"2. It is essential that the position of the patient's head should be firmly fixed, and the best position for the head which unites facility of operating with the least danger is the medium position with the mouth not too widely open.

"3. The incision with the knife should only be made through the mucous membrane, the deep exploring for pus being done with a dull instrument.

"4. It is very dangerous to carry the wound more than a centimeter and a half deep, particularly when a sharp or pointed instrument is used.

"5. The knife must never be directed backward and outward and the surface of the cut must be parallel with the long axis of the mouth.

"6. The position for the incision should be determined by the method of Thomson, who advises that the wound should be made in the apex of the external inferior quadrant, which is determined by drawing a line horizontally through the base of the uvula and another line vertically through the anterior edge of the anterior faucial pillar.

"Sixteenth. In cases of postoperative bleeding following operations on the tonsils and the lateral pharyngeal wall, hemostatic measures should be undertaken in the following order:

"1. The application of Mikulicz's compression forceps.

"2. The sewing together of the palatal arches.

"3. The compression of the common carotid artery.

"4. The ligature of the common carotid artery or its branches.

"Seventeenth. Tonsillotomy should be avoided as far as possible in cases of nephritis, hemophilia, diseases of the gall-bladder, during menstruation and during acute inflammatory processes in this region."

Although this article of Bulatnikow's is apparently based on a rather large amount of research and anatomical dissection, there are contained in his conclusions certain statements which should not be allowed to go uncriticised. In the first place, there is very little danger of wounding the carotid arteries during a carefully conducted tonsillectomy or in opening a suppurative process in the peritonsillar tissue, provided, of course, ordinary care be exercised. The bleeding following tonsillotomy is just as apt to be severe as that following the complete operation, though this is probably due to the fact that in tonsillotomy a sharp instrument is used, whereas tonsillectomy is usually done with a duller instrument, such as the snare wire. Of course, in anomalous conditions, unskilful attacks on the lateral pharyngeal wall or on deeply buried tonsils may possibly endanger some of the large bloodvessels. I have in 1 case,

after an enucleation, seen the internal carotid artery pulsating very close to the surface of the wound. There have also been 2 cases brought to my notice of death following within a few minutes after tonsillectomy due to severe hemorrhage of the throat. In 1 of these cases, the bleeding was found (postmortem) to be due to an unusually large tonsillar branch which had been severed very close to an anomalous origin from the external carotid. This branch usually comes from the facial artery. In the other case the source of hemorrhage was undetermined, and may have been either from the facial, which occasionally loops upward very close to the inferior pole of the tonsil, before it passes externally around the mandible, or from an anomalous internal carotid artery.

It is possible that some of the severe cases of hemorrhage following immediately upon a tonsil operation result from wounding the internal carotid artery. This artery sometimes forms curious anomalous loops in the pharynx which may bring it into a comparatively close relationship with the tonsils. Fisher[1] reports 2 cases in which he describes an anomalous tortuosity of the internal carotid artery. In the first case the artery made a letter S loop, running forward, then downward, and then forward again and upward. The first part of the curve laid between the internal pterygoid muscle and the back part of the upper surface of the tonsil, with the superior constrictor muscle intervening. The second bend also came in relationship with the upper part of the tonsil and again with the superior constrictor muscle intervening. This condition was bilateral, but no other arteries were found to be tortuous.

In the second case the bend was higher up, and the artery did not come into as close contact with the tonsil as in the first, although it was much closer than normally found. Fisher believes that the abnormal pulsation occasionally seen in the lateral and retropharyngeal wall is almost always due to a sigmoid tortuosity of the internal carotid artery, and not, as has been frequently supposed, to an enlargement of the ascending pharyngeal artery.

As a clinical example of the possible danger of this tortuosity is a case reported by F. F. Agnew.[2] At the operation the hemorrhage was very slight, but two hours later there was a sudden severe hemorrhage which was partially controlled by the use of adrenalin in the fossa and pressure over the common carotid artery. The bleeding, however, was still too profuse to permit of ligation, so that a tonsil clamp had to be applied. By this time the patient was exsanguinated, with no pulse at the wrist. The clamp was removed the next morning. In about five days she had recovered sufficiently from the hemorrhage to be taken to her home in the country, where severe hemorrhage again took

[1] Lancet, July 17, 1915, p. 128.
[2] Annals of Otology, Rhinology, and Laryngology, March, 1915, xxiv, 44.

place and was controlled as before, except that the clamp was left in place for thirty-six hours. On removal of the clamp, an examination of the wound showed that on the upper third of the posterior surface there was a space of about $\frac{1}{3}$ by 1 cm. in diameter where the muscle fibers had been torn away. Presenting in this space could be seen an artery about the size of a quill, the walls of which were very "sloughy" looking. The author believed this artery to be a anomalous internal carotid and acting on this belief ligation of the common carotid was done. Except for some infection of the wound and rather slow healing, the child made an uneventful recovery. I am not surprised that, after this experience, Agnew is of the opinion that all tonsillar operations should be done in the hospital and considered in the light of major surgical procedures.

The average tonsil operation is not difficult, as a rule accompanied by no complications, gives rise to comparatively little discomfort, and is followed by brilliant results. For this reason it is being done in enormous numbers, both by skilled and unskilled operators, and, unfortunately, many look upon it as a rather frivolous procedure, apparently not realizing that there are many exceptions to this rule. For this reason I want to emphatically state that numerous deaths have followed the operation, the majority of them being due either to a failure to appreciate such a possibility or to carelessness in preparation, or to lack of skill and experience on the part of the operator and those in attendance upon the patient after the operation has taken place. It is probable that a certain number of fatalities following tonsillar operations are unavoidable, but that surgeon is in an uneviable position, who, through carelessness or lack of understanding of the difficulties and dangers which may accompany tonsil enucleation and adenectomy, fails to provide all possible precautions against accident. Proper preparation of the patient beforehand, asepsis, hospital facilities, competent anesthetist and assistants, careful nursing and watching afterward are called for as strongly as in any other operation, and the failure to provide these safeguards is unjustifiable on the part of the surgeon.

## THE LARYNX

**Papilloma of Larynx.** The treatment of papilloma of the larynx has always been most unsatisfactory though from time to time new methods, medical, operative or electrical, have been proposed and some seemed to be pregnant with great promise. However, time has shown that certain cases no matter what form of treatment is used are apparently intractible. Harmon Smith[1] reviews his experiences with the more promising of the methods which have been proposed, and it may be well to recall to our readers what can be done for the relief

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[1] Journal of American Medical Association, December 19, 1914, p. 2207.

of this most distressing condition by quoting from his article. He says that laryngofissure was at one time believed to be effective in the removal of these growths and in the prevention of the recurrence, but the experience of many operators has demonstrated that this is not only ineffective in the majority of instances but permanently injures the voice so that it is now deemed an absolutely unjustifiable procedure. In adults, the removal of the growth, either by indirect or by direct laryngosopy, offers fair hope of its eradication, although in many instances recurrence takes place even though the base is cauterized. In the multiple variety in children, surgical removal not only results in recurrence of the growth at the site of the operation but likewise occasions new growth to spring up on the neighboring mucosa. Fulguration seems to promise more and will result in at least the temporary disappearance of the growth, and recurrence is postponed longer than when operative measures are alone employed. Fulguration should be done under cocain anesthesia, if possible, and, if done under ether, the child should be permitted to breathe for at least one-half minute after the anesthetic is removed before the fulgurating spark is applied. The fulgurating applicator should be well insulated and the tip placed on the wart before the spark is turned on and also the current shut off before the point is removed, otherwise the current will be transmitted to the metallic speculum. Unless the fulguration is excessive, no edema or untoward symptoms result; though Smith has seen 1 case of edema, following excessive fulguration, which required tracheotomy. He says that the best surgical method for these cases and the one which is the most invaluable in meeting multiple papilloma in children is tracheotomy. The advantages of tracheotomy are that it permits the patient to breathe comfortably without surgical interference to the growth itself, thus allowing time for the physiological change to take place which eventuates in the disappearance of the papilloma. Radium has been applied in a number of instances and in some cases marvellous results have been obtained, but, in a case of Smith's absolutely no change could be noted even after numerous applications. He believes that alcohol in adults may be of some service, but, in the multiple papilloma of children, it is apparently without any affect. Smith further suggests that it may be possible, by the inoculation of the patient with emulsions of the papillomatous growth, to produce an immunity which would tend to prevent their recurrence. He has, however, not had a chance to try out this theory.

A case of *multiple papillomata of the larynx in a child cured by radium* is reported by Emilo Martinez.[1] This boy was treated by external application for fourteen days with radium, during a total of eighty-one hours. This external treatment was useless, and tracheotomy had to

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[1] III Cogreso Med. Nacional de Cuba, December, 1914.

be done. The radium was then placed inside a hard-rubber intubation tube without any metal, and this was placed in the larynx and left there for a session of several hours. The radium employed was 10 milligrams of one-fourth purity, and enclosed in a platinum sheath. From January 17 to February 10 seven treatments were employed. By the first day of February his voice was better, and he could breathe through the larynx. When last seen, about eight months after the last application, there had been no recurrence, the patient had a normal voice and natural respiration.

That the use of radium in the treatment of papilloma of the larynx is not without danger is shown in a case reported by F. E. Hopkins.[1] The radium in this case was applied through a tracheotomy tube, under ether, and held in place for forty-five minutes. The growth disappeared and the tracheotomy wound was allowed to close, and for a time breathing through the larynx went on reasonably well. About a month later, dyspnea recurred and tracheotomy again became necessary. At this time no growth could be seen in the larynx and the stenosis was found to be due to adhesions occupying the anterior three-fourths of the glottis. A little later a narrow ring of grayish growths could be seen on the upper side of the laryngeal opening. There was little doubt but that the adhesions in this case resulted directly from burns by the radium. Hopkins says that, in order to eradicate papilloma by radium, repeated applications are necessary because of recurrence and that therefore great care must be exercised in making the exposures so as to avoid burns which may be followed by cicatricial contraction.

W. E. Casselberry[2] reports 2 interesting cases of *infected lymphoid growths of the laryngopharynx*, secondary to sinus suppuration. In the first case, the laryngopharynx was occupied by six separate growths running from the lower border of the tonsillar fossa down to the posterior plane of the arytenoids. In spite of rather wide surgical removal, and the use of the *x*-ray, these growths redeveloped until finally the breathing began to be embarrassed. A pure culture of the Streptococcus hemolyticus was obtained from some of the tissue and a vaccine prepared. Although an initial dose of only 50,000,000 was advised, 500,000,000 was given and a change in the condition was noticed within twelve hours, and within two days a visible diminution of the redeveloped growth could be noticed. 50,000,000 of the vaccine were given biweekly until finally the whole neoplastic growth disappeared. The second case was very similar, and in the tissue was found the same Streptococcus hemolyticus. The initial dose was not so large as in the first case, nor was the effect so prompt. All activity, however, soon ceased, and the budding redevelopment gradually disappeared. The unoperated growths subsided slowly.

[1] Annals of Otology, Rhinology, and Laryngology, December, 1914, p. 878.

[2] Journal of American Medical Association, February 13, 1915, p. 576.

In a case of LARYNGEAL STENOSIS occurring in a little girl nineteen months old, which had resulted from the inspiration of hot steam, Barwell[1] employed a rather ingenious method for fixing the dilating tube. He had an extra long intubation tube made out of vulcanite of the same diameter along its whole length except at the head where there was the usual flange and a slight taper at its extremity. The lower end was cut obliquely to facilitate introduction. This tube was marked with a heated brad-awl passed through the tracheotomy fistula and then a groove was cut in it at this level. A clamp was made of two separable arms, like minature obstretical forceps. The grasping blades fitted around the groove in the tube and the free ends projected through the tracheotomy wound. The patient was extubated two and a half months later and did very well.

H. Mallet[2] suggests, in cases of intubation where ulceration has resulted, that instead of doing a tracheotomy the ulcer should be cauterized by the introduction of a tube covered with alum. This coating the writer makes by preparing a thick paste of alum, starch water and a little glycerin. The tube is coated with this mixture and allowed to stand until thoroughly set. He believes that this method of coating the tube is superior to that of Bouquet's who utilizes a thick layer of gelatin impregnated with alum and which he molds around the tube.

True DIVERTICULA OF THE LARYNX are exceedingly rare conditions, so much so that Shambaugh and Dean Lewis[3] have been able to collect from the literature only 14 cases which can be accepted without reserve, after a critical examination of data given, as being real laryngeal diverticula. Shambaugh and Lewis classify diverticula into three types: (1) The extralaryngeal; (2) the intralaryngeal, and, (3) the combined type. They report 1 case belonging to the combined type. In this case there were two sacs, one of which was external to the larynx and the other on the inside of the larynx, but connected with the external one by an opening about the size of a lead-pencil. The authors report in detail the cases which they have collected from the literature, so that to one interested in this subject the article should be seen in the original. They believe that these diverticula are congenital, and are analogous to the air sacs found in howling monkeys. As far as treatment is concerned, the extralaryngeal sacs can be easily removed. The intralaryngeal can sometimes be enucleated after incising the thyreohyoid membrane, but it may be necessary to split the thyroid cartilage longitudinally before the sac can be reached. Intralaryngeal methods of attacking the intralaryngeal sac are very unsatisfactory.

In examining cases of UNILATERAL PARALYSIS OF THE RECURRENT LARYNGEAL NERVE, the limitations of movement seem to be always in a

[1] Lancet, January 2, 1915, p. 16.
[2] Rev. Med. de la Suisse Romande, August, 1915, p. 454.
[3] Annals of Surgery, January, 1915, p. 41.

transverse direction, so that it is interesting to read the result of the study of Rudolf Hoffmann[1] on other changes of position of the vocal cords which may follow recurrent paralysis. He says that in many cases of paralysis of the recurrent nerve there is a distinct difference in the height of the vocal cords, which difference shows itself most distinctly during phonation. This alteration in the height of the cord is due to action of the cricothyroideus of the same side. The cricothyroideus muscle, being the only muscle on that side of the larynx unaffected, pulls upward the edge of the cricoid cartilage, because there is no resisting force offered to this movement, on account of the paralysis of the intrinsic muscles. The movement of the cricoid, of necessity, raises the arytenoid body. The condition can be mechanically corrected by bending and lowering the head toward the paralyzed side, or by wearing a compress above the cricoid so applied as to hold it in its place. Possibly an operative attempt might be made to bring about a closer approximation of the anterior portion of the cricoid to the thyroid cartilage, thus preventing the rocking of cricoid.

**Carcinoma of the Larynx.** An interesting case of a SPONTANEOUS DISAPPEARANCE OF A CARCINOMATOUS GROWTH OF THE LARYNX is reported by Pugnat.[2] The patient was a man, aged sixty years, and, when examined, showed the presence of an oval red tumor about the size of a bean, occupying the entire left arytenoid region down to the left vocal cord. A fragment was removed, and microscopic examination confirmed the clinical diagnosis of carcinoma. Surgical intervention was refused by the family so that the case could only be treated expectantly. However, the tumor gradually decreased in size, and after some weeks the voice was almost normal in tone. Examination, at that time, showed a decrease in the size of the growth and by the end of the following month it had absolutely disappeared. A lymph node of the left side of the neck, which had been enlarged, did not disappear, but even increased in size, and eleven months later the patient returned with a submaxillary growth about the size of a mandarin orange. The larynx, however, had remained perfectly normal. The submaxillary tumor continued to grow and death occurred from hemorrhage of the carotid artery.

**Laryngoscopy.** Lynah,[3] for the treatment of chronic laryngeal stenosis, has devised a *laryngeal speculum* which follows closely the mechanism of the bivalve vaginal speculum. The instrument resembles the general shape of Jackson's laryngoscope, but has a flat spatula for the lower blade with an opposed upper blade fastened to the side of the handle and made to open away from the lower blade by a thumb-screw on the back of the handle. The spatulas or lower blades are inter-

[1] Zeitschrift f. Laryngologie, Rhinologie, und ihre Grenz, April 15, 1915, p. 547.
[2] Arch. internat. de Laryngo., d'Otol. et de Rhinol., May–June, 1914.
[3] Journal of American Medical Association, March 27, 1915, p. 1066.

changeable, so that either an infant or adult spatula may be readily attached to the universal handle, as desired. The spatulas have double light carriers, one of which may be used for a thin suction carrier, if desired. For handling the intubation tube he uses a common introducer-extractor which is made with an upward tilt so that the tube engages the larynx easily. For the dilatation of the strictures, he has made a cigar-shaped tube, and, in those cases where there is a tendency for the
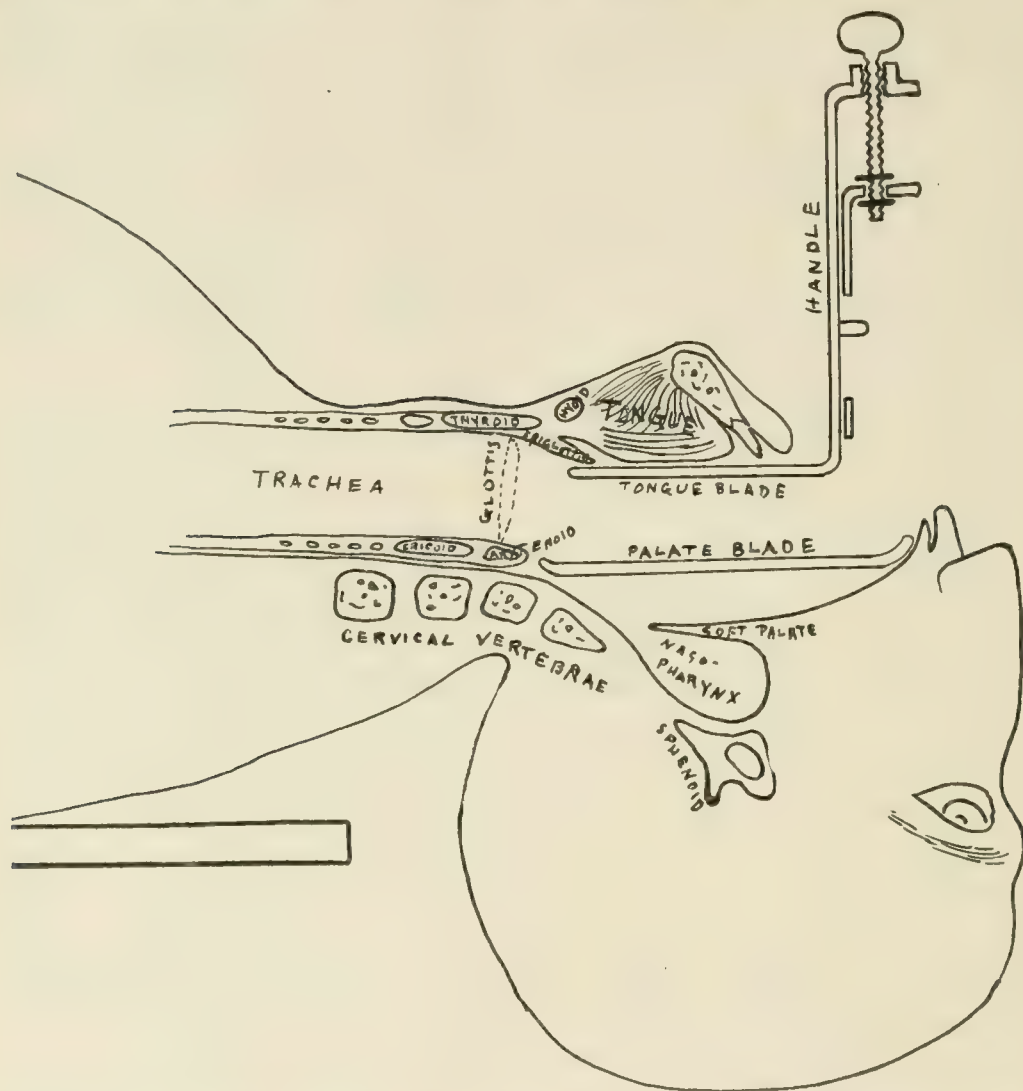


Fig. 19.—Diagram showing instrument in position with blades separated and cords in view

tube to be coughed up, he employs one with a large bulbous end. He also has devised post tubes which have a rod-like device that can be screwed into the tube through the trachial fistula. The tube is first introduced and scratched through the wound so that the scratch mark corresponds to the trachial fistula. It is then removed and a threaded hole bored to accommodate the post.

This post tube of Lynah's seems a much simpler method of holding the tube in place than the slightly more elaborate clamp suggested by Barwell, of London.

Another bivalve speculum for laryngeal work is the *self-retaining laryngoscope* suggested by Max Unger.[1] This instrument consists of a tongue blade, a palate blade with its supporter and screws for connecting and manipulating them. The tongue blade, which is fastened to the handle, is long enough to reach to the base of the epiglottis, while the palate blade reaches from the hard palate just back of the teeth to the cervical vertebræ near the arytenoid cartilages. The ends of the palate blade are so shaped as to fit against the proper parts without injuring them. The supporter of the palate blade lies flat on the handle of the tongue blade to which it is fastened by a screw arrangement. This screw controls the movement of the palate blade supporter and permits the two blades themselves to move either to or from each other. The distal end of the palate blade can be made to approach or recede from the distal end of the tongue blade by turning a screw controlling a lever which extends from the palate blade up alongside of the handle of the instrument. In the introduction, the instrument is pushed sufficiently far down the pharynx so that the proximal end of the palate blade slips inside the teeth, and the tongue blade passes over the back of the tip of the epiglottis. The blades can then be separated by the thumb-screw in the handle and the examination made.

A rather interesting case of FOREIGN BODY IN THE LUNGS is that of a little girl, aged six years, who had a tack lodged in the eparterial branch of the right main bronchus. The case is reported by Wilhelm Lerche.[2] At the first bronchoscopic examination, about 5 mm. of the sharp end of the tack was noticed in the right main bronchus, with the point downward and appearing as if it had been stuck through the wall from the outside. Forceps were applied and attempts were made to extract it, but the lower part of the lung was pulled up with it for considerable distance before the forceps slipped off. It was believed that the head of the tack was in the eparterial bronchus and the swelling was so great as to make forcible extraction practically impossible. Three days after the first bronchoscopy, with a special knife having a short hook which cut upward, an incision was made through the neck of the eparterial bronchus, through a 5 mm. bronchoscope. A gush of dark blood poured forth but ceased as soon as the bronchoscope was withdrawn. Seven days later bronchoscopy and the x-rays showed the tack to be in the same old position. Through the bronchoscope, however, the incision could be seen and when the forceps were applied to the tack it was found entirely loose. When it was lifted out, it fell headforemost into the lower hyparterial bronchus whence it was quickly picked up and removed.

[1] Laryngoscope, December, 1914, xxiv, 995.
[2] Journal of American Medical Association, December 12, 1914, p. 2129.

# OTOLOGY.

## By TRUMAN LAURANCE SAUNDERS, M.D.

DURING the past year a search of the literature has revealed nothing startlingly new in the specialty of otology. ·

The war in Europe still casts its blight upon productive effort in research, and the energy of otologists in England and on the Continent is absorbed in caring for the wounded from the front. Barany, one of the foremost investigators in our specialty, has been captured by the Russians, and it is reported that Austria is already making efforts for his exchange.

The author regrets that no new effective therapeutic results have been obtained in the treatment of *chronic catarrhal otitis media*. It is to be hoped that efforts along this line will not cease, for while the treatment of established catarrhal conditions of the middle ear is tedious and often without result, we cannot help feeling that, at times, we otologists become too easily discouraged, and do not give the deaf the mental support, the encouragement, and the occasional supervision that they need.

Until our therapeutics of this condition become more effective, it is encumbent upon the otologist to act as councillor and as advisor to the patient, in order that he may become the best adjusted to his environment.

In *acute suppurative conditions* of the middle ear no special progress has been made. The author thinks that he can discern a growing tendency on the part of pediatricians to regard the acute suppurations of the middle ear as belonging to their especial domain.

We recommend the increasing ability of the pediatrist to recognize a red and bulging drum, and we must admit the fact that certain "gifted" members of this specialty are able to do a paracentesis of the drum membrane. It is a different matter, however, when it comes to the diagnosis of acute mastoiditis in infants or young children. Even more difficult is the question of operation in all suppurations which tend to become chronic. The pediatrist is apt to regard an early incision of the drum membrane as a specific against acute mastoiditis, and is ignorant of the fact that in a small proportion of the cases the middle ear and mastoid are involved simultaneously, and that incision of the drum simply delays the appearance of mastoid symptoms until the suppuration in the mastoid has gained enough momentum to make their appearance irresistible.

Whether the local application of *suction or negative pressure to the middle ear* is going to be of practical benefit in the beginning of the middle-ear suppurations, and in the cases complicated by acute mastoiditis, it is yet too early to say.  The author feels, however, that the intense swelling of the mucoperiosteum of the middle ear and aditus that is seen in some cases, will effectively block all efforts toward draining the antrum or mastoid process by suction applied through the middle ear.

In the *treatment of acute mastoiditis*, the author feels that the specialty no longer merits the condemnation that was somewhat justly put upon it a few years ago, for its undue radicalism.  The majority of our brethren now admit the fact that was most forcibly pointed out to them at that time by their more conservative leaders, that most of the cases of acute mastoiditis in private practice recover without mastoid operation under the simpler measures of free incision of the drum membrane, rest in bed, restricted diet, and aural irrigations.  It has become the function of the otologist to watch these cases, to see that these measures are intelligently applied, and to determine whether the case will recover without operation.  The questions of when to operate and when not to operate demand, in certain cases, the exercise of the greatest judgment.

The results and the technic obtained by the otologist in operating upon the ear and mastoid process have reached such a degree of perfection that his field has not yet been, nor is it likely to be, invaded by the general surgeon.  The discouraging results obtained by them in the occasional hospital cases they have undertaken have led them, at least in private practice, to leave the ear and mastoid process to the aural surgeon.

With a growing knowledge of *labyrinthine conditions* is coming a corresponding ability to place the labyrinthine inflammations in their proper operative and non-operative classes.  With out ability to tell early what lesions will invade the cranial cavity, will come better results in our labyrinthine surgery.  Thus far, the lumbar puncture seems to be the most efficient laboratory aid at our disposal, and more attention is being paid to the cell count and the reduction reactions of the spinal fluid.  During the past year especial emphasis has been laid on the labyrinth as an organ of equilibrium, and on its relation to the central nervous system.  This will be alluded to later.

The results of the *Haynes decompression operation for meningitis* have not fulfilled our early hope.  As a palliative measure in relieving the suffering of the patient it may be of some value, but as a curative measure it is disappointing.

The author prophesies that in the future fewer primary skin grafts will be used in the radical operation; in his opinion the *risk* of the graft in the hands of the average aural surgeon should deter its being advocated as an acceptable form of operative technic.

In *sinus thrombosis*, no important advances have been made. The value of blood cultures in the diagnosis and prognosis of this condition is still generally admitted, notwithstanding the fact that occasionally positive cultures are found in cases which apparently have no thrombosis present. In the author's mind, however, there always lurks the possibility of a thrombus in a small sinus other than the lateral or sigmoid, and also that a sinus thrombosis may recover spontaneously without operation. Such is the difficulty of stating that a case has not a sinus thrombosis.

At this point the author wishes to call attention to one other fact; he believes that in the near future the acute discharging ears of infancy and early childhood, of long duration but without frank mastoid symptoms, will be submitted to the mastoid operation much more frequently than in the past. Otologists are beginning to recognize the fact that in these stubborn cases it is often better to do a mastoid operation and institute posterior drainage of the middle ear, rather than to trust to drainage *via* the auditory canal to take care of an ear and mastoid antrum full of infected granulations.

Glogau has contributed an interesting article on the

**Occupational Diseases of the Ear.**[1] His experience was obtained while investigating the cases for the New York State Factory Investigation Commission. It is of special interest to those physicians who do work in the ear dispensaries of our large cities.

The industries investigated, where occupational diseases of the ear and upper respiratory tract occur in a very large measure, are as follows: (1) clothing; (2) textile; (3) metal; (4) fur; (5) chemical; (6) tobacco; (7) printing."

In these conditions dust and lack of proper ventilation are evidently the causes of the diseases of the upper respiratory tract, while the ear is affected by the noise in the factory or, secondarily, by the diseased conditions in the nose and throat.

Some of Glogau's conclusions are as follows: "The upper respiratory tract and ear are undoubtedly damaged by the dust that contains minute particles of ostrich feathers, fur and cordage materials, and by the noise found in the cordage mill. In 119 of the 155 workers examined, particles of the working material were found in the nose; in 91 cases particles were found in the throat. Eighty-four cases of middle-ear catarrh were found. In 62 furriers examined, 33 had middle-ear catarrh and in 4 of these there was an affection of the inner ear. This is remarkable because there was little noise in the fur factory.

In a cordage mill examined, there was excessive noise due to many machines, and the air was filled with minute particles of hemp, jute, etc. In this mill 44 workers were examined, 28 cases of middle-ear

[1] Diseases of the Ear and Upper Respiratory Tract among American Factory Workers, New York Medical Journal, March 27, 1915.

catarrh were noted, and in everyone of the 44 cases there was some involvement of the acoustic nerve.

As preventive measures, Glogau suggests minimization of the dust evil, medical examination of workers in dusty trades upon entrance into the trade, and a subsequent examination every six months. Appropriate medical treatment should be instituted. If impairment of hearing due to noise is found, the workers should be transferred to some other part of the factory.

In regard to affections of the acoustic nerve, he makes the following interesting statement: "Experiments upon animals and examinations of artillerymen have proved that a great part of the air concussion is transmitted to the acoustic nerve by the ground on which the individual stands, and not by air alone. The movements of the machine are imparted to the floor and thence to the body of the worker, and in this way reach and affect the acoustic nerve. An excellent preventative measure would be the isolation of the worker from the floor by the use of heavy shoes with rubber soles, or a thick rubber floor covering. The worker should also wear some easily attachable sound damping appliance in the shape of a cap. Cotton in the ear will close the ear canal, but will not prevent noises from reaching the acoustic nerve by means of bone conduction."

**Deafness in Childhood.** In an article on "Severely Impaired Audition in Childhood,"[1] Hubby makes the following statements: "Severe deafness occurring from the fourth to the eighth year often results in loss of speech, notwithstanding didactic efforts. After the seventh year deafness seldom leads to mutism."

He divides deafness into two classes, congenital and acquired, the larger being the acquired. He thinks that heredity and consanguineous marriages play an important part in the congenital class. In the acquired form he quotes Love, who says that one-third of the acquired cases follow meningitis, one-third scarlet fever and measles, and the remaining third, typhoid, diphtheria, mumps, whooping-cough and syphilis.

As prophylactic measures, he advocated avoidance of intermarriage in the congenitally deaf, and the correction of the defects in the nose and throat at as early an age as possible.

He favors education of the deaf child both with the voice and with the Zund-Burgnet electrophone. In educating the deaf-mute, he favors the oral, rather than the manual or combined methods.

Jouet[2] also classifies the deaf as congenital and adventitious. He includes in the congenital class, those who have become deaf in infancy, "as it is difficult to know in the first few months after birth whether a

[1] New York Medical Record, December 25, 1915.
[2] Prophylaxis of Deafness, Laryngoscope, February, 1915. From the French of Robert Jouet, Revue Generale de l'Enseignment des Sourds-Muets, June, 1914.

child can hear or not." He calls adventitiously deaf those children who, having really spoken at one time, have become deaf as the result of some illness and have consequently lost the use of speech (generally in children less than eight). He does not believe that consanguinity plays the important part we attribute to it. He says: "The influence of consanguinity is undoubted, still it does not seem to deserve such ostracism (in preventing marriage between the consanguineous) because marriage between first cousins is far from always producing deaf children." "Statistics we have personally made very recently give us, among 470 deaf children, a proportion of 7 per cent. as issue of first cousins, and for the children of parents consanguineous in any degree, a proportion of 10 per cent."

To the fact that the specialist is consulted more promptly, and to the fact that the "otites" are better treated, he attributes the decrease in the percentage of the adventitious cases, and the consequently apparent increase in the percentage of the congenital cases. In conclusion, Jouet advocates as prophylactic measures:

A. Against congenital deafness.
1. Discourage as much as possible consanguineous marriages.
2. Forbid the marriage of a syphilitic who has not had regular treatment.
B. Against adventitious deafness.
1. Treatment of otitis.
2. Radical operation for adenoid growths no matter at what age.
3. Disinfection of the nostrils and ears in all children suffering from infectious diseases.
4. Specific treatment of all children suffering from hereditary syphilis.
5. Monthly visits by an oto-rhinologist to all school children.

**Tuberculosis of the Ear.** A. Logan Turner and J. S. Frazier[1] have contributed a most interesting and exhaustive article on this subject, which has been hitherto more or less neglected by otologists in this country. I take the liberty of quoting very freely from the summary of the article.

Of 1797 cases of middle-ear suppuration, they found 60 cases tuberculous, 51 in children under fifteen years, and 9 in adults. The majority of these cases were in their first or second year.

Their statistics show that under the age of two years 27 per cent. of the cases of purulent otitis media are due to tuberculosis, and under one year, 50 per cent. On the other hand, if cases of otitis media of all ages are taken, only 2.8 per cent. are tuberculous. They say, "We have not yet obtained proof that these infantile cases are due to the

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[1] Tuberculosis of the Middle Ear Cleft in Children, etc. Reports for the year 1914, Ear and Throat Department, Royal Infirmary, Edinburgh; Journal of Laryngology, Rhinology and Otology, June, 1915.

bovine type of tubercle bacillus, but if we may reason from the work done by John Fraser on tubercle of bone, and by Philip Mitchell on tubercular adentitis, we think . . . that the great majority of cases are due to the bovine bacillus introduced into the system by the drinking of unsterilized cows' milk."

They regard the type of tuberculous otitis media occurring in the advanced stages of pulmonary tuberculosis as relatively infrequent.

"The route of infection is still a matter of dispute. It is generally agreed, however, that there are two possible routes: (*a*) By way of the Eustachian tube, and (*b*) By the blood stream."

Infection *via* the tube may occur either by the tubercular infiltration in the walls of the tube spreading upward into the tympanum, or by the passage of tuberculous material through the lumen of the tube into the tympanum.

They hold that the most frequent route of infection is *via* the Eustachian tube, and state that definite proof of a hematogeneous infection can only be obtained by postmortem examination. It may be surmised, however, if at operation the mastoid alone is found diseased and the tympanum and tube are found healthy.

They mention *six types of tubercular otitis media and interna:* (*a*) Lupoid; (*b*) an infiltrating form; (*c*) a fungating or more chronic form; (*d*) a necrotic form, with rapid necrosis and caseation; (*e*) a fibroid form (Herzog); (*f*) a fibro-ossifying form, characterized by an effort at spontaneous cure by the formation of new-formed fibrous tissue and bone.

The *clinical characteristics* are as follows: (*a*) Age and feeding (*vide supra*); (*b*) onset painless in 92 per cent. of their cases; (*c*) enlarged periostic glands in 95 per cent. of their cases; (*d*) aural discharge, watery or flocculent, in the early stages before mixed infection is present; (*e*) facial paralysis is present in 45 per cent.; (*f*) multiple perforations in the adult.

In regard to labyrinthine involvement, their statistics show labyrinth necrosis present in 22 per cent. of the cases operated on, and in a further 31 per cent. an erosion of the labyrinth wall.

They believe that tubercular infection reaches the labyrinth *via* the round and oval windows, that the external semicircular canal is not so often attacked as in the cholesteatomatous cases. On the other hand, the promontory is more often diseased than in the simple cases.

Their diagnosis of tubercular otitis was made on the following points:

(*a*) Clinical characteristics (*vide supra*).

(*b*) The findings at operation.

(*c*) Examinations of ear discharge for tubercle bacilli by staining films with carbol-fuchsin and decolorizing with sulphuric acid in alcohol.

(*d*) Injections into guinea-pig after treating discharge with anti-formin or ericolin.

They state that "tubercular otitis media does not appear to give

rise to serious intracranial complications to any marked extent, although tubercular pachymeningitis externa is frequently met with at operation." Tubercular meningitis and tubercular brain tumors or abscesses are met with at postmortem, in cases operated on, but they believe these due to the general tuberculosis and not as a direct result of the tubercular otitis media and interna.

The authors state the prognosis of tuberculous otitis media to be unfavorable.

In regard to operating on these cases, the authors hold the middle position between extreme conservatism and extreme radicalism. "If the patient is suffering from advanced phthisis pulmonalis or tubercular meningitis, operation is contra-indicated unless the ear condition is giving severe pain."

They believe that a radical operation is always indicated in tubercular cases on account of the infection *via* the Eustachian tubes, and that the simple mastoid operation is limited to those rare cases of apparent hematogeneous infection of the mastoid.

In operating on these cases they believe it advisable to "freely expose the dura of the middle and posterior fossa, because dura forms a better barrier to the tubercle bacilli."

They also advocate most strongly appropriate antitubercular after-treatment. For local after-treatment they advise sodium iodide in increasing doses, and packing the wound with gauze soaked in peroxide of hydrogen. The tuberculin treatment is not mentioned.

TUBERCULIN. H. H. Briggs[1] advocates the use of tuberculin in the treatment of tuberculosis of the ear. He says he can see no reason why it should not be given in properly selected cases. "It should not be used in the acute fulminating cases when the body is already over-burdened with toxins and the reactive forces are exhausted beyond the power of stimulation by tuberculin.

"Theoretically, bacillen emulsion (B. E.) should confer a greater amount of antitoxin immunity, and old tuberculin (O. T.) and bouillon filtrate (B. F.) a greater amount of antibacterial immunity." He says, however, the particular tuberculin employed is of no great importance.

"The most important element in tuberculin therapy is the corelation of the size of the dose and the tolerance of the patient."

He mentions 2 postoperative cases treated with tuberculin in which its use seemed of benefit.

During the past year, Cocks and Dwyer[2] have given us a new method for determining the presence of tubercle bacilli in discharge from the middle ear. By this method the organisms are isolated from the discharge and cultivated upon special media, animal inoculation is eliminated and much time saved.

[1] Annals of Otology, Rhinology and Laryngology, September, 1911.
[2] Laryngoscope, March, 1915.

The following are the directions employed by Cocks and Dwyer for isolating and cultivation of the tubercle bacilli from a discharging ear:

"The method we employ is somewhat different from Petroff's. It is really a combination of Petroff's method of isolating from sputum and his method for feces. This modification was rendered necessary in the large number of spore-forming organisms often present in chronic otitis. Our technic is as follows:

"After obtaining the aural discharge in wide-mouthed bottles, it was immediately saturated with sodium chlorid and allowed to stand from half an hour to an hour. At the end of this time the bacteria are found floating on the surface. This floating film is then collected with a deflagration spoon in a wide-mouthed bottle and an equal volume of normal sodium hydroxid added. The mixture is shaken well and left for digestion in the incubator at 37° C. for one or two hours or longer, care being taken to shake it every half-hour. The mixture is then neutralized to sterile litmus paper with normal hydrochloric acid, and the sediment is inoculated into several test-tubes. Growth usually occurs in from fifteen to thirty days.

Petroff's media is suggested as the most reliable one and is prepared according to S. A. Petroff[1] after the following:

"Two parts of egg (white and yolk), one part of meat-juice, Gentian violet sufficient to the proportion of 1 to 10,000. Meat-juice 500 gm. of beef or veal are infused in 500 c.c. of a 15 per cent. solution of glycerin in water. Twenty-four hours later the meat is squeezed in a sterile meat press and collected in a sterile beaker.

"Eggs. Sterilize the shells of the eggs by immersion for ten minutes in 70 per cent. alcohol, or by pouring hot water upon them. Break the eggs into a sterile beaker and after mixing the eggs well, filter through sterile gauze. Add one part by volume of meat-juice.

"Gentian violet. Add sufficient 1 per cent. alcoholic gentian violet to make a dilution of 1 to 10,000.

"Pour about 3 c.c. in each sterile test-tube and inspissate for three successive days—on the first day at 85° C.—until all the medium is solidified, changing the places of the tubes if necessary on the second and third days for not more than one hour at 75° C. For the bovine type omit the glycerin and infuse the meat for twenty-four hours in water. Bovine tubercle bacilli grow in this medium, even if it contains glycerin, but on account of the popular belief, and the lack of data, we used a medium without the glycerin.

"From a careful calculation it appears that if a single organism divides in two, it will take approximately from six to seven days to grow to a pin-point colony and be visible. To confirm this, five organisms were isolated by Barber's method and inoculated in a test-tube containing

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[1] Journal of Experimental Medicine, January, 1915, p. 39.

gentian-violet-egg-meat-juice media. Every twenty-four hours the tubes were examined. On the sixth day three pin-point colonies were visible. The strain of the tubercle bacilli used in this experiment was well adapted for growth outside the body, having been isolated two years previously. This experiment shows that under most favorable conditions it will take at least six days for a single tubercle bacillus to grow to a visible colony."

They briefly report 3 cases isolated by this method.

**Syphilis of the Auditory Nerve.** Swift and Ellis,[1] of the Rockefeller Institute, have contributed an interesting article on this subject.

"The onset of sudden or rapidly progressing deafness in patients with syphilis is a not uncommon occurrence. It is usually considered to be a lesion of the eighth nerve or labyrinth, and the prognosis for the regaining of hearing by the patient is considered unfavorable.

"It is the purpose of this article to show that these affections should not be considered and treated as instances of isolated disease of the organ of hearing, but merely as manifestations of that extremely serious condition, syphilis of the central nervous system."

They quote statistics from Habermann and Rigaud to show that about 50 per cent. of the cases of syphilis of the ear occur in the secondary stage. In regard to the influence of salvarsan on the eighth nerve they state: "The figures which are given above suggest that the great increase in frequency of such cases ('nerve relapses' in paralysis of the cranial nerves) which is claimed to have resulted from the use of salvarsan has been exaggerated; but that the severity of these affections of the cranial nerves in early syphilis is rather markedly increased and somewhat more frequent in patients *inefficiently* treated with salvarsan seem to be indisputable facts." They quote Gennerich, who has carefully studied the phenomenon of increased severity in the relapses following salvarsan. "He considers that this increased severity in patients insufficiently treated with salvarsan is due to the absence of the resistance to local expansion of the syphilitic process which usually develops in syphilitic subjects coincident with the appearance of the secondary- eruptions. This is the process which leads to the spontaneous regression of the primary lesion in untreated cases of syphilis. The absence of this resistance to local expansion of the syphilitic process in patients treated with salvarsan, he ascribes to the rapid elimination of the mass of the infecting treponemas. If the case has been inefficiently treated a few organisms remain in some foci difficult to reach with the curative agent. Such foci are frequent in the nervous system. The development of organisms remaining in such a focus in a patient treated with salvarsan takes place, therefore, rapidly in the form of an intense local infiltrating lesion, simulating a primary lesion in its devel-

opment. From these relapsing foci, if the patient has no further treatment, a fresh general infection of the body may occur."

In regard to the exact location of the lesion they mention the findings of Knick and Zaloziecki,[1] and add that "they seem to prove that in the early cases at least, the disturbance of the auditory mechanism are due to an involvement of the eighth nerve on the course of a syphilitic meningitis. They report 7 cases of this condition all of which responded to salvarsan rather than mercury and potassium iodide.

"Cases 1 and 2 were rather typical 'neurorecidives' with no definite meningeal symptoms before salvarsan treatment was instituted. Both showed involvement of the facial nerve on the side of the affected ear; the first had an optic papillitis at the time of the development of the deafness, and the other developed a similar condition a few months later. Both had general symptoms of an intense meningitis, and the cerebrospinal fluids were turbid and gave very high cell counts. In both there was practically complete restoration of function of the nerves involved. Case 3 might also be regarded as a 'neurorecidive' except for the fact that he had distinct symptoms of meningeal irritation early in the disease before any treatment was administered. The deafness appeared one month after the first salvarsan injection, but was promptly and apparently completely relieved by the second injection. The symptoms of meningitis reappeared, however, and the patient showed hyperemia of the optic disks when first examined by us. Case 4 had evidence of meningeal, auditory and optic nerve involvement at the time of appearance of the general secondary eruption. These symptoms were only partially alleviated by mercury inunctions, but there was complete return of function after a single short course of neosalvarsan. Case 5 had severe symptoms pointing to meningeal involvement before the outbreak of the secondary rash, which only slowly disappeared under mercury and iodids. Later he had two attacks showing profound involvement of the cerebral tract before the onset of deafness. Case 6 developed deafness, vertigo and visual disturbance while under mercury, with prompt alleviation of symptoms following a single dose of salvarsan."

B. Alexander Randall and Isaac H. Jones[2] have contributed an instructive article entitled the "Ear Tests of Barany in Locating Cerebellar and other Encephalic Lesions," in which they consider at length the so-called pointing reactions.

They briefly describe the normal pointing reactions and then state: "A normal person past points either to the right or left according to stimulation because he has a disturbed sensation of his position in space."

They believe that the tract for the nystagmus reaction is now definitely established, i. e., through fibers of the eighth nerve to Deiters's,

[1] Berlin. klin. Wchnschr., 1912, xlix, 639.
[2] Transactions of American Otological Society, xiii, 111.

von Bechterew's, and the triangular nucleus in the medulla and thence fibers to the nuclei of the sixth, fourth and third cranial nerves in the pons.

The *cerebellar circuit* is not so definite. They believe, however, that fibers from the horizontal canals go to the Deiters group (of nuclei?) and thence to the cerebellum by way of the juxta-restiform body (the internal portion of the inferior cerebellar peduncle), through to the cerebellar nuclei "globosus, fastigii and emboliformis and thence to the cortex on both sides." "The fibers of the superior canal have an apparently different course, going directly to the posterior longitudinal bundle, probably entering the cerebellum through the middle peduncle."

They have come to the conclusion that all pointing reactions are primarily cerebral and not cerebellar.

They assert that by these pointing tests "we can usually differentiate lesions of the labyrinth from the cerebellum: we can always tell when the eighth nerve is diseased; we can say positively also whether the posterior longitudinal bundle is affected, and we can detect a lesion of the cerebellum, but cannot always locate it."

They offer two new contributions to the subject: "1. The subjective circuit. We postulate this circuit through the cerebellum to the higher centres and in proof cite:

"(*a*) Two patients who had perfect nystagmic reaction but no past pointing and no vertigo.

"(*b*) Several cases of spontaneous nystagmus with no vertigo.

"(*c*) In most cases of cerebellar lesion dizziness is either absent or subnormal.

"(*d*) A patient with no nystagmic reaction and yet normal past pointing and vertigo.

"As the two latter reactions seem to go together, it may be concluded at least for the time being, that the impulses which are concerned with vertigo pass through the cerebellum. Also, arguing backward, if no vertigo is obtained it may prove that there is a lesion in the cerebellum.

"2. Our second postulate is that the fibers from the different semi-circular canals have entirely separate tracts of their own; that there is one nystagmus, one cerebellar, and one subjective tract for the horizontal canal and an entirely different set of the three tracts for the superior canal.

"This we have found in 11 cases by means of the following phenomena: In all of these there was little reason to doubt that the region of the posterior longitudinal was implicated. In each of these cases douching of the superior canal (that is, with the head upright) produced neither nystagmus, past pointing nor vertigo; whereas on stimulation of the horizontal canal (with the head back 90 per cent.) all of the reaction came through promptly—nystagmus, past pointing, and vertigo. It is therefore evident that there is a complete central differentiation for the different canals of all three tracts."

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